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MONTANA AIR QUALITY DATA & INFORMATION SUMMARY FOR 1982

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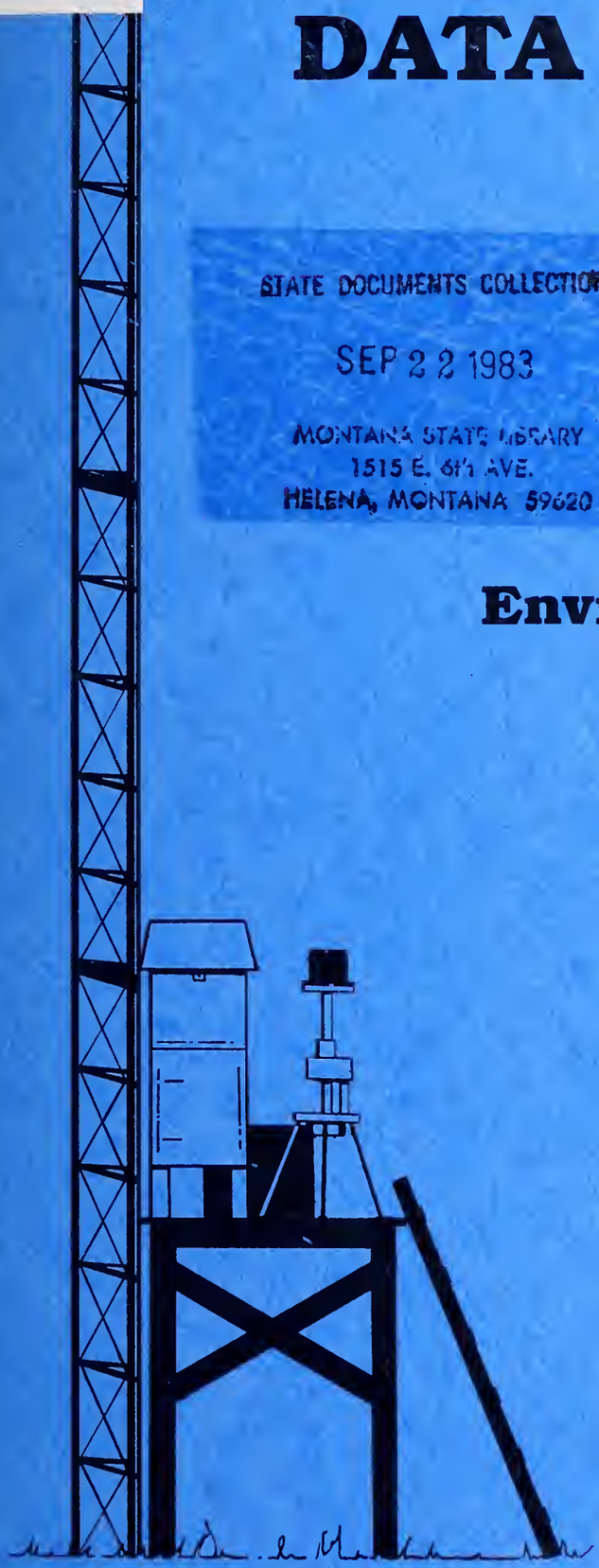

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MONTANA AIR QUALITY DATA AND INFORMATION SUMMARY FOR 1982

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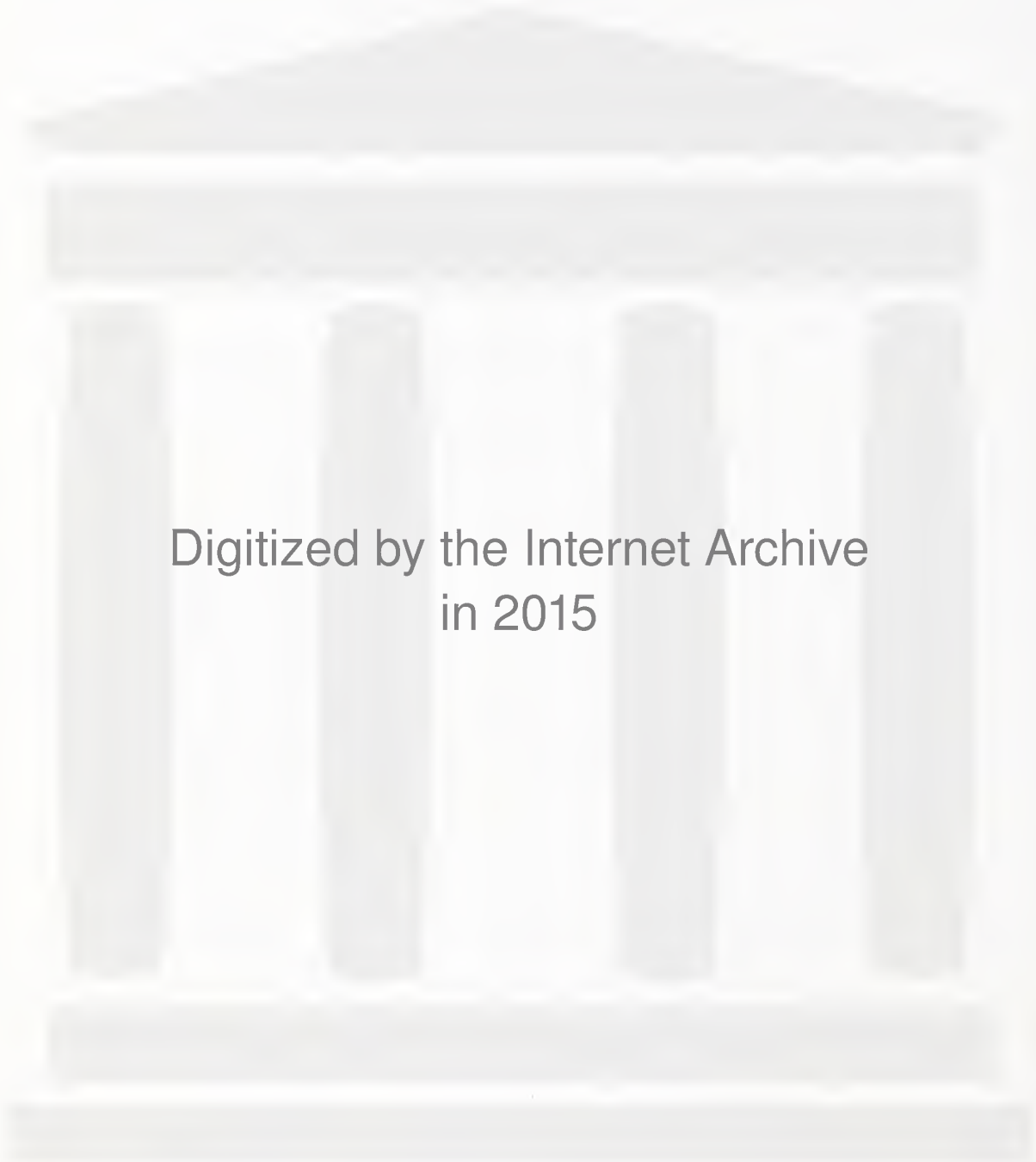
August 1983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I.
INTRODUCTION

I. INTRODUCTION

The Montana Air Quality Data and Information Summary for 1982 serves two primary purposes. The first is to summarize air monitoring data from various areas of the state; the second is to provide information on several air quality topics.

The 1982 Data Summary will be presented in two parts consisting of (1) data summary and (2) informational appendices. A supplementary report, 1982 Data Analyses, including all the statistical analysis and associated plots for most of the air monitoring sites operated by the Air Quality Bureau, is available upon request.

The data summary portion is intended as an overview of monitoring activities throughout the state for 1982. For purposes of discussion, we have divided the state into ten study areas. Within each area we have provided the reader with various background information. This includes population growth or decline, climate and geography as it relates to air quality, and lists of possible air pollution sources. Following this information, we have tabulated the ambient data and made comments with regard to its significance.

The second portion of this report includes several appendices on a variety of topics relating to air quality. This includes discussions on Prevention of Significant Deterioration, Attainment-Non Attainment, Ambient Air Quality Standards, Smoke Management and Visible Emission Documentation. Other miscellaneous tables, lists and short reports are included for the reader's benefit and informational needs.

The Data Analyses supplement will contain more information about ambient data collected; more specifically, the statistical analysis and associated plots, wind roses, and diurnal continuous monitoring plots for most of the monitoring sites operated by Air Quality Bureau.

Although this report is entitled the 1982 Data Summary, 1981 data has also been included. Reporting two years of data has the added benefit of allowing the reader to compare one year to another.

The subject of air quality is often complicated and data intensive. It cannot be covered completely in any one report. We hope that this report will serve the needs of most data and information users.

II.
STUDY AREAS

II. STUDY AREAS

The data summary portion of this report is divided into ten study areas. Within each area, we have provided various background information. This includes population growth or decline; climate and geography; and listings of air pollution sources. For each study area, monitoring site descriptions are given and site locations are shown on an area map.

The ambient data is listed in various ways. Total suspended particulate (TSP) concentrations are tabulated showing annual geometric averages, highest and second-highest daily concentrations. Continuous data are tabulated giving monthly averages and highest hourly concentrations except for carbon monoxide, where the highest eight-hour average is also provided. Metals, sulfates and nitrates are tabulated in the same manner as TSP. Tables of sulfation rate and fluoride give annual averages and the highest monthly average. Fluoride vegetation is given in monthly average and grazing season. Visibility is given in back scatter with reciprocal meters for units and is tabulated as monthly averages, highest hourly aveage and annual average.

Table I lists all monitoring stations which were active in 1982. Some stations didn't provide enough data for analysis but nevertheless are included to present the total monitoring network. Table II lists meteorological sites, locations, dates of operation and types of meteorological equipment operated at each site.

The data included in this report are a combined effort of the Air Quality Bureau (Montana Department of Health and Environmental Sciences), the Cascade County Air Pollution Control Agency, the Missoula City-County Health Department, the Yellowstone County Air Pollution Control Agency, Lewis and Clark County Health Department, and Gallatin, Flathead, Sanders, Ravalli, and Richland Counties, as well as the National Park Service.

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	Nitrate	Sulfate	Metals	S Rate	SO_2	F Vegetation	CO	F	Met
Anaconda											
	Lincoln School	x			x						
Big Horn County											
	*Decker #6 AQB Lab	x									
Billings											
	Lockwood School	x				x					
	KGHL	x				x					
	City Hall	x				x					
	Grand Ave. School	x				x					
	Garden Ave.					x					
	County Offices					x					
	Bench School					x					
	Bitterroot					x					
	Johnson Lane					x					
	Mountain View Blvd.					x					
	1200 Minn. Ave.					x					
	5th & 28th					x					
	27th & 10th Ave. So.					x					
	East Conoco					x					
	Two Moon Park					x					
	Newman School					x					
	Klenck School					x					
	Johnson & Lockwood					x					
	Johnson Rd. N.					x					
	Woodland					x					
	Coburn Road					x	x				x
	Fairgrounds (Metra)						x		x		x
	Taft School	x					x				x
	Piccolo & Frontage Rd.					x					
	Shawnee Park						x				x
	No. Johnson Lane						x				x
	Lockwood Park						x				x

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	Nitrate	Sulfate	Metals	S Rate	SO_2	F Vegetation	CO	F	Met
Bozeman											
	Traphagen Hall	x									
	East Main	x									
	*Whittier School	x									
Butte											
	Greeley School	x									
	Hebgen Park #2	x									
	Walkerville (Blaine Sch)	x									
	Dr. Canty	x									
	Ueland #1							x			
	Ueland #2							x			
	Ueland #3							x			
	Ueland #4							x			
	Hilderman #5							x			
	Hilderman #6							x			
	Tamietti #7							x			
	Tamietti #8							x			
	Erickson #9							x			
	Erickson #10							x			
	Erickson #11							x			
	Spangler #12							x			
Columbia Falls											
	Anders Residence	x									
	NAAC										
	Doane							x			
	Hoffman							x			
	Liddle							x			
Daniels County											
	Scobey Border #1	x	x	x			x				x
	Richardson	x	x	x							
	Hanrahan	x	x	x			x				x
East Helena											
	Hastie	x			x	x					
	Hadfield	x			x						
	South	x									
	Dartman	x									

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	Nitrate	Sulfate	Metals	S Rate	SO2	F Vegetation	CO	F	Met
Flathead County											
	Polebridge	x	x	x	x						
	Bigfork	x	x	x							x
	Whitefish	x	x	x							
	Glacier Int. Airport	x	x	x							x
	Big Prairie Met										x
Gallatin County											
	Big Sky Golf Course										x
Glendive											
	Dawson Co. Comm. Coll.	x									
	Glendive Med. Arts Cnt.	x									
Great Falls											
	Fire Station #1	x									
	Kiwanis Park	x									
	Riverview School	x									
	Black Eagle	x									
	Lincoln School	x							x		
	GF Federal							x			
	Downtown	x									
Havre											
	Central City Bldg.	x									
Helena											
	Cogswell Bldg.	x									
	Capital Courts	x									
	Super Save Groc.	x									
	Cooney Home	x									
	Montana City	x			x						
Jordan		x									

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	Nitrate	Sulfate	Metals	S Rate	SO_2	F Vegetation	CO	F	Met
Kalispell											
	Universal Athletic	x	x	x							
	Evergreen Rural Elec.	x									
Lake County											
	Polson	x	x	x							x
	Ronan Minepipes	x	x	x							x
	Swan River	x	x	x							
Laurel											
	Junior High	x				x					
	1 Mi. NE Coop					x					
	3/4 Mi W. Coop					x					
	1/2 Mi S Coop					x					
	St. John Church					x					
	E. of Laurel					x					
	Farm E. of Cenex					x					
	West Coop					x					
	New Farm	x					x				x
	*Laurel BN						x				x
Lewistown											
	Downtown	x									
Libby											
	Brown Residence	x									
Miles City											
	PCA Bldg.	x									

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	Nitrate	Sulfate	Metals	S Rate	SO_2	F Vegetation	CO	F	Met
Missoula County											
	Malfunction Junc. S.E.									x	
	Courthouse Roof	x		x							
	Hoerner-Waldorf #1	x		x							x
	Hoerner-Waldorf #2	x		x							
	Rose Park	x		x			x				x
	*Boyd Park	x							x		
	Lolo	x									
	Northside	x									
Powell County											
	Smith Ranch (Ovando)	x									

*New site in 1982

KEY

TSP - Total Suspended Particulate
S Rate - Sulfation Rate
SO_2 - Sulfur Dioxide
F Vegetation - Fluoride vegetation sampling
CO - Carbon Monoxide
F - Fluoride
Met - various meteorological parameters

TABLE II

LOCATIONS OF METEOROLOGICAL EQUIPMENT

Site	Site ID	Code	County	City	Wd	AR	Neph	PyhM	PyrM	BP	Temp	DP	Long/Lat UTM*	Date of Op
Central Park	0080 059	F01	Yellowstone	Billings	X				X	X	X	X	1083219-454651	8/78-5/80
Billings Vo-Tech	0080 302	F02	Yellowstone	Billings		X								6/78-9/82
Farm E. of CENEX	0840 009	F01	Yellowstone	Laurel	X								1084435-453939	1/77-7/80
Laurel (New Farm)	0840 014	F02	Yellowstone	Laurel	X								1084425-454007	10/81-6/82
Taft School	0080 062	F01	Yellowstone	Billings	X				X	X	X	X	1082938-454637	8/80-12/82
Lockwood School	0080 006	F05	Yellowstone	Billings	X								1082630-454757	8/79-5/80
Fairgrounds	0080 061	F02	Yellowstone	Billings	X								1082845-454755	9/80-12/82
Shawnee Park	0080 063	F02	Yellowstone	Billings	X									1/81-12/82
Coburn Road	0080 066	F05	Yellowstone	Billings	X								5073.3-697.4*	9/81-12/82
Lockwood Park	0080 065	F05	Yellowstone	Billings	X								5075.5-700.0*	9/81-12/82
North Johnson Lane	0080 064	F05	Yellowstone	Billings	X								5079.1-701.1*	9/81-12/82
Laurel BN	0840 015	F05	Yellowstone	Laurel	X								5059.5-675.1*	9/81-12/82
Kiwanis Park	0660 016	F01	Cascade	Great Falls	X								1111632-473035	1/80-2/80
Lincoln School	0020 007	F02	Deer Lodge	Anaconda	X				X	X	X	X	1125634-460731	7/78-6/81
Hiway Jct.	0040 004	F02	Deer Lodge	Anaconda	X	X							1125317-460809	10/77-8/79
County Airport	0400 704	J02	Deer Lodge	Anaconda	X								5111.5-356.5*	2/79-5/79
No. 2 Discharge Pond	0400 708	J02	Deer Lodge	Anaconda	X								5113.5-362.0*	1/79-5/79
Weather Hill	0400 707	J02	Deer Lodge	Anaconda	X								5110.7-354.1*	1/79-5/79
Mill Creek	0400 706	J02	Deer Lodge	Anaconda	X								5107.0-354.5*	1/79-2/79
Alpine West	0160 015	F02	Silver Bow	Butte	X								1123032-450045	8/76-6/78
Hebgen Park	0160 017	F01	Silver Bow	Butte	X		X						1123129-460013	6/78-12/80
Microwave	0760 903	F02	Jefferson	E. Helena	X								1115501-463244	1/78-3/79
A&W	0860 008	F02	Lewis&Clark	E. Helena	X								1115425-454637	2/80-6/80
Big Sky Golf Course	0520 004	F05	Gallatin	Big Sky	X								5012.5-477.5*	6/81-12/82
Randall Ranch	1240 009	F03	Powder River	Broadus	X									9/77-8/78
Fort Peck	0980 001	F03	McCone	Ft. Peck	X								1062959-475943	9/77-5/79
Fisher Butte	1360 003	F03	Rosebud	Lame Deer	X								1063914-453734	
BN Site	1360 027	F02	Rosebud	Colstrip	X								1063443-455130	8/78-12/78
Scobey #1 (Border)	0340 001	F03	Daniels	Scobey	X	X	X	X	X	X	X	X	1052400-485930	3/77-12/82
Scobey #2 (Richardson)	0340 002	F03	Daniels	Scobey	X								1052513-484835	8/78-5/79
Scobey #4 (Hanrahan)	0340 004	F05	Daniels	Scobey	X						X		1141500-481838	11/80-12/8

TABLE II

LOCATIONS OF METEOROLOGICAL EQUIPMENT

Site	Site ID	Code	County	City	Wd	AR	Neph	PyhM	PyrM	BP	Temp	DP	Long/Lat UTM*	Date of Op.
Big Fork	0480 036	F05	Flathead	Big Fork	X						X		1140557-480400	11/79-12/82
Kalispell Airport	0480 304	F05	Flathead	Kalispell	X	X	X	X	X	X	X	X	1141500-481838	1/78-12/82
Water Supply	0480 302	F05	Flathead	Col. Falls	X				X		X		1140830-482000	10/76-6/78
Polebridge	0480 305	F05	Flathead	Polebridge	X						X		1141703-484709	9/78-11/78
Big Prairie	0480 308	F05	Flathead	Polebridge	X						X		1141841-484829	11/78-5/82
Ronan-Ninepipe	0820 012	F05	Lake	Ronan	X	X	X						1140759-472735	1/79-12/82
Polson	0820 304	F05	Lake	Polson	X						X		1140727-474120	10/78-12/82
Ronan	0820 011	F05	Lake	Ronan	X								1140546-473054	1/80-3/80
TV Mountain	1100 701	J05	Missoula	Missoula							X		1135200-470000	5/78-4/80
Lions Park	1100 019	F01	Missoula	Missoula	X		X		X	X	X	X	1140025-465105	12/77-8/80
Stiegler	1100 703	F05	Missoula	Missoula	X								1140814-465415	5/78-3/80
Olofson	1100 702	F05	Missoula	Missoula	X								1140424-464949	7/78-3/80
U of M	1100 704	F05	Missoula	Missoula	X								1135840-465150	5/78-3/80
Rose Park	1100 020	G01	Missoula	Missoula	X		X		X	X	X	X	1140014-465126	9/80-12/82
Malfunction Jct. SE	1080 005	F01	Missoula	Missoula	X								*5192.5-727.5*	4/80-5/80

*UTM values recorded in kilometers

Wd - wind speed, wind direction and wind direction standard deviation
AR - Acoustic radar
Neph. - nephelometer
PyhM - Pyrheliometer
PyrM - Pyranometer
BP - Barometric pressure
Temp - temperature
DP - dew point

A. ANACONDA

A. ANACONDA

The Anaconda study area includes only two monitoring sites in Deer Lodge and Powell counties (Table A-1 and Figure 1-A). In the past, the majority of the air monitoring conducted in this area centered around the city of Anaconda. However, in mid-1981 the Air Quality Bureau shut down most of its air monitoring sites in the area due to the closure of the Anaconda copper smelter.

Deer Lodge county and the southern half of Powell county contain the Deer Lodge valley and surrounding mountains. The valley slopes from an elevation of 5,200 feet at Anaconda in the south to approximately 4,400 feet at Garrison at the north end. The Anaconda-Pintlar Wilderness lies to the south and west, the Flint Creek range to the west, and the Continental Divide to the east. The area is subject to temperature inversions about 40 percent of the year.

The north half of Powell county is separated from the Deer Lodge Valley by a range of mountains and generally lies in the upper Blackfoot Valley.

The smelter is being demolished and the sampler at Lincoln School will continue to monitor for future trends of TSP and metals.

Table A-I

Anaconda Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Anaconda Lincoln School	Deer Lodge	State AQB	Population oriented	Suburban-residential	Cedar Street, Anaconda
Smith-Ranch (Ovando)	Powell	State AQB	Background	Rural-agricultural	Five miles E. of Ovando

Figure 1-A

ANACONDA

Air Monitoring Stations

1. Lincoln School

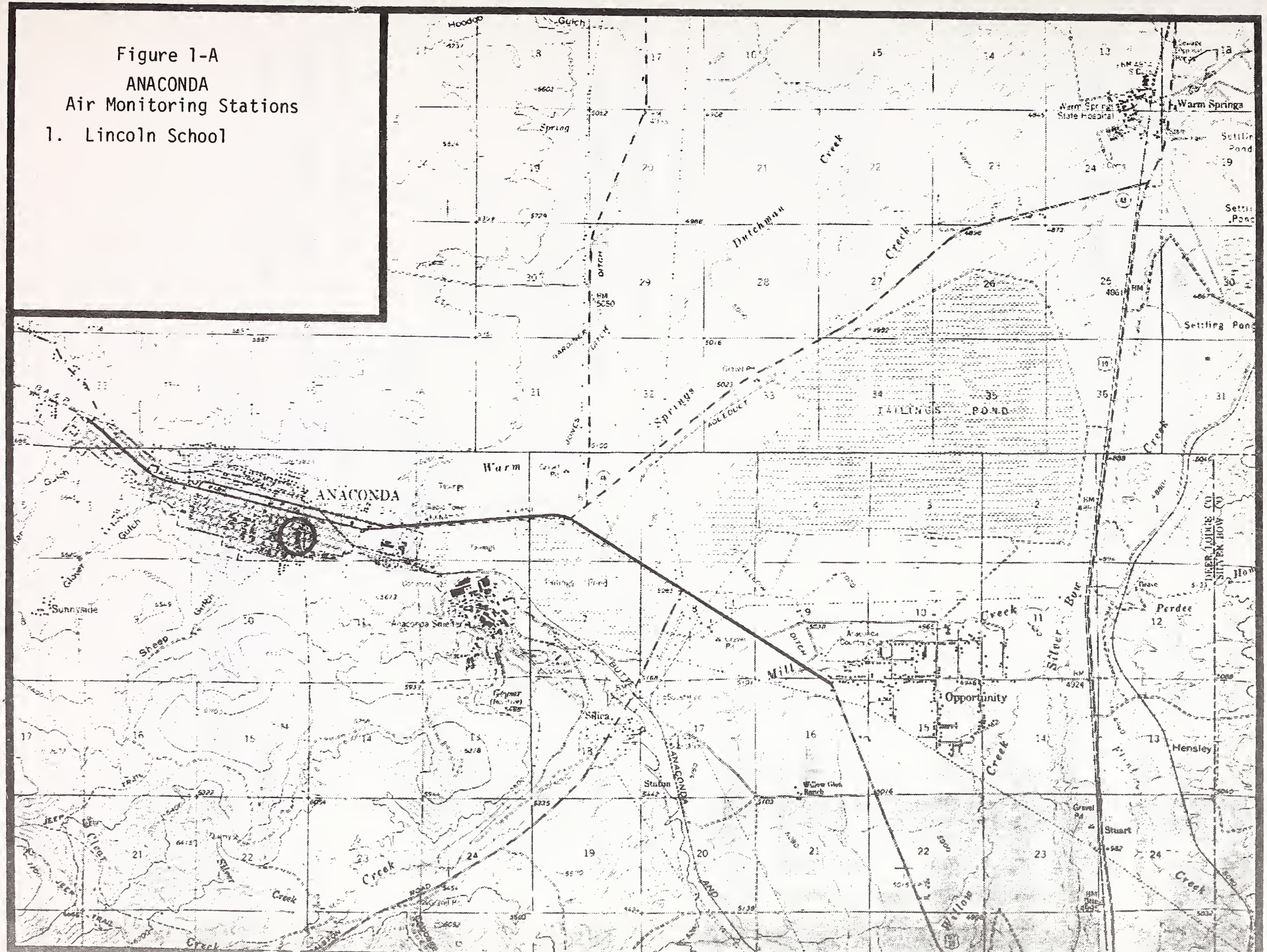


Table A-II summarizes TSP values from the Lincoln School site in Anaconda as well as the Smith Ranch (Ovando) site in Powell County, which is indicative of background for western Montana. Although some high TSP readings were recorded, none violated the Federal 24-hour standard (260 ug/m^3) and the annual means were all well below the 75 ug/m^3 standard.

Table A-II
Anaconda Area - TSP
Micrograms Per Cubic Meter

	1981			1982		
Site	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Lincoln School	45	149	142	35	128	125
Smith Ranch (Ovando)	16	98	71	14	79	79

Trace heavy metals such as lead, cadmium and arsenic were analyzed by atomic absorption from high volume sampler filters through July. The remainder of the year samples were analyzed by ICAP. The Air Quality Bureau continued to monitor lead at the Lincoln School site during 1982. Table A-III gives a summary of lead analyses done on hi-vol filters from the Lincoln School site. Lead is of particular interest because of its high toxicity.

Table A-III
Anaconda Area - Lead
Micrograms Per Cubic Meter

	1981			1982		
Site	Mean	1-High	2-High	Mean	1-High	2-High
Lincoln School	.07(12)	.37	.19	.04(12)	.31	.18

( ) - parentheses denotes number of sample months

Wind in the Anaconda area tends to be southwesterly much of the year. During the spring the wind is predominately from the northwest. These winds provide ventilation which keeps the inversion frequency lower than other areas of Western Montana. This statement is probably not true for the upper Blackfoot Valley.

B. BILLINGS

B. BILLINGS

The Billings study area includes air monitoring sites in Yellowstone County. The area is located between the Northern Great Plains and the Rocky Mountains; consequently, it has climatic conditions common to both regions. The elevation for this area ranges from 3100 to 3400 feet above sea level. Billings and Laurel both receive about 14 inches of precipitation per year. Population growth has been substantial in the last ten years. This is primarily due to coal and oil development. Yellowstone County's population increased 23 percent from 87,367 in 1970 to 107,661 in 1980; Billings' increased 11 percent from 61,581 to 68,343 and Laurel's 23 percent, from 4,454 to 5,469.

Pollution sources include the following:

1) Three oil refineries (SO_2, particulate, H_2S hydrocarbons, NOx, SO_3)
2) Coal-fired power plant (SO_2, particulate, NOx)
3) Sugar beet refinery (SO_2, particulate, NOx)
4) Sulfur plant (SO_2, SO_3)
5) Wood-fired home heating devices (fine particulate, CO)
6) Automobiles (CO, NOx, re-entrained particulate)

Billings and Laurel area monitoring sites are listed on Table B-I and shown in Figures 1-B and 2-B respectively.

Table B-II summarizes TSP values for Billings and Laurel area hi-vols. None of these sites violated the Federal Primary annual TSP standard (75 ug/m^3), but the Taft School site recorded two readings in excess of the 150 ug/m^3 24-hour secondary standard.

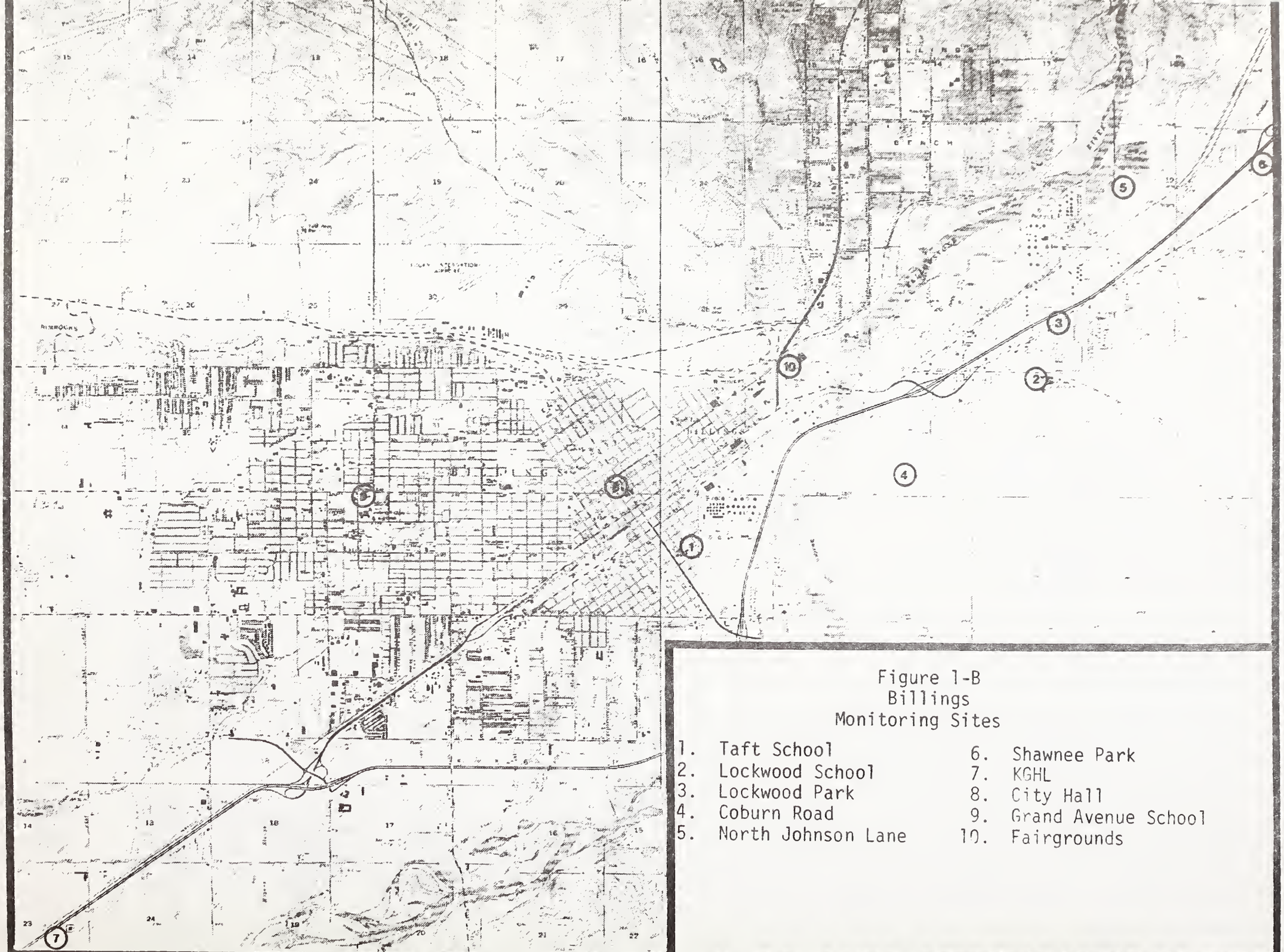


Figure 1-B
Billings
Monitoring Sites

1. Taft School
2. Lockwood School
3. Lockwood Park
4. Coburn Road
5. North Johnson Lane
6. Shawnee Park
7. KGHL
8. City Hall
9. Grand Avenue School
10. Fairgrounds

Figure 2-B
Laurel
Monitoring Sites

1. Laurel Jr. High
2. Laurel New Farm
3. Laurel BN

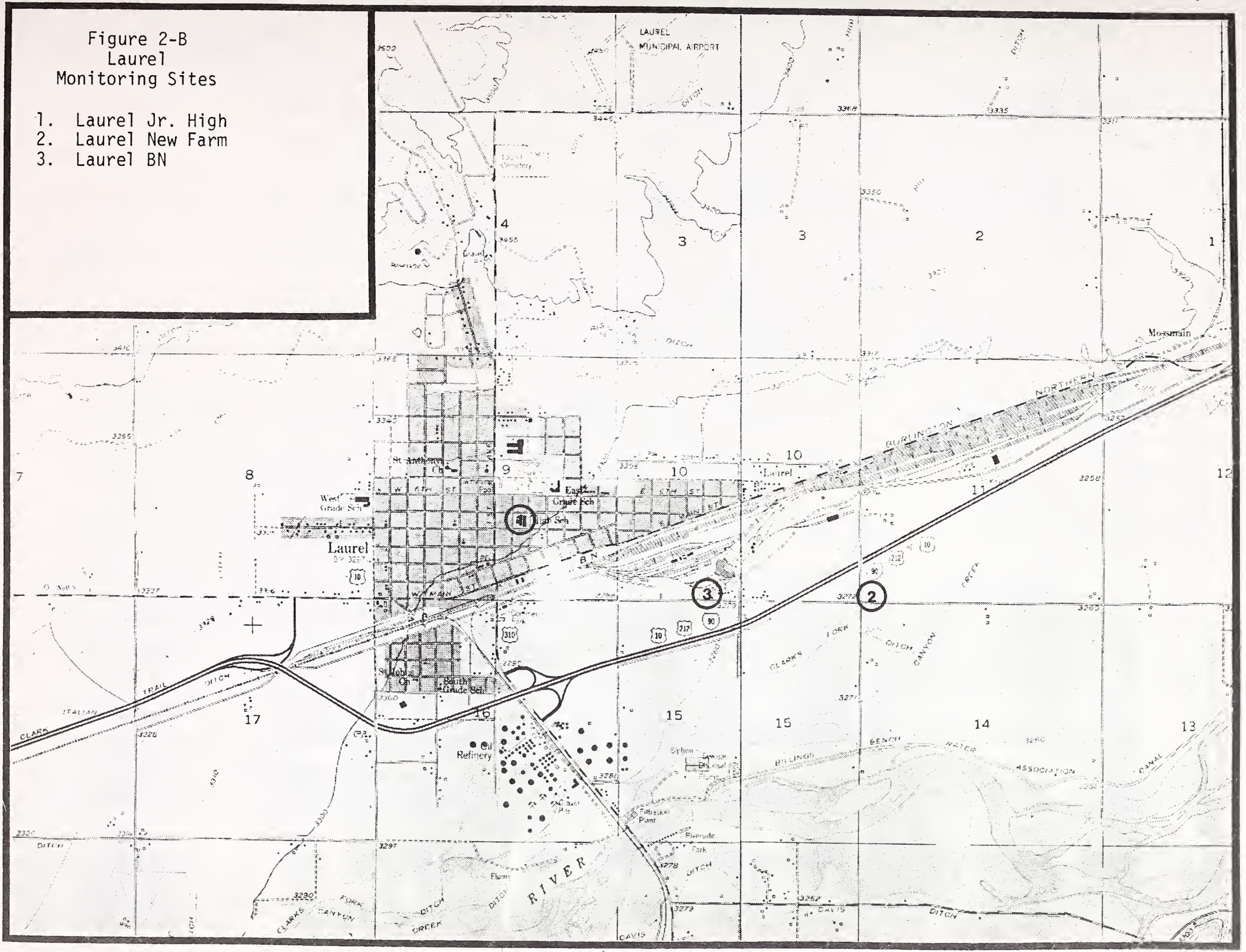


Table B-I

Billings Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Billings					
Lockwood School	Yellowstone	State AQB	Source Oriented	Suburban-industrial	E of Billings Lockwood School Complex
Lockwood Park	Yellowstone	State AQB Contractor	Source Oriented	Suburban-industrial	Lockwood area Little League Park
Coburn Road	Yellowstone	State AQB Contractor	Source oriented	Rural-rangeland	On ridgetop 1/2 mile S of Lockwood exit of I-90.
No. Johnson Lane	Yellowstone	State AQB Contractor	Source oriented	Rural-agricultural	1 mile W of the I-90 Hardin Interchange
**Shawnee Park	Yellowstone	State AQB	Source oriented	Rural-residential	At the I-90 Hardin interchange
**KGHL	Yellowstone	*YCAPC	Population oriented	Rural-agricultural	KGHL Station 3 3/4 miles W of Billings on Highway 10
City Hall	Yellowstone	*YCAPC	Population oriented	Center city - commercial	3rd Avenue N & 27th Street Downtown Billings
Grand Ave. School	Yellowstone	*YCAPC	Population oriented	Suburban-commercial	Grand Avenue School adjacent to Billings Business District
Fairgrounds(Metra)	Yellowstone	State AQB	Source oriented	Suburban - industrial	Fairgrounds Complex, 6th Ave. N and Exposition Drive
Taft School	Yellowstone	State AQB	Source oriented	Suburban-industrial	Near Taft School in SE Billings
Laurel					
Jr. High School	Yellowstone	*YCAPC	Source oriented	Center city - residential	Laurel Jr. High School on Colorado Avenue
***New Farm	Yellowstone	State AQB	Source oriented	Rural-industrial	2.5 mile NE of Refinery
**Laurel BN	Yellowstone	State AQB Contractor	Source oriented	Suburban-industrial	BN switchyards east edge of Laurel

*YCAPC-Yellowstone County Air Pollution Control
**Shut down September, 1982
***Shut down June, 1982

Table B-II
Billings Area - TSP
Micrograms Per Cubic Meter

Site	1981 Geo. Mean	1981 1-High	1981 2-High	1982 Geo. Mean	1982 1-High	1982 2-High
KGHL	47	171	160	38	92	89
Grand Avenue School	72	165	157	56	124	119
City Hall	69	182	155	59	153	107
Taft School	64	271	234	54	162	152
Lockwood School	*47	148	102	37	100	82
Laurel Jr. High	39	126	83	33	77	74
Laurel New Farm	43	142	134	*28	107	60

*Less than eight months data

Sulfur dioxide was analyzed at eight locations in the Billings-Laurel area in 1982. Table B-III summarizes the maximum hourly reading for each month as well as the monthly and annual means. Four sites: Coburn Road, Lockwood Park, North Johnson Lane and Laurel BN, were operated by a private contractor as part of the Billings SO_2 Study. The AQB also ran, during the winter months from December 1981 to April 1982, an SO_2 continuous monitor at the Metra-Fairgrounds site. A more detailed report on the four sites that were operated by private contractor from September 1, 1981 to September 1982 is available.

There were some violations of the Montana ambient SO_2 standards. There were 13 exceedances of the Montana one-hour SO_2 standard. The Montana law allows 18 exceedances of the one-hour standard of 0.500 ppm SO_2 before a violation is valid. Fifteen violations of the Montana 24-hour standard were reported during 1981 and 1982. Five occurred at North Johnson Lane, one in 1981 and four in 1982; two violations were reported at Lockwood Park in 1982, with none in 1981; and Coburn Road reported a total of eight violations, five occurring in 1981 and three occurring in 1982.

Table B-III
Billings Area - Sulfur Dioxide
Parts Per Million

	Taft School - 1981		Taft School - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.162	.016	.147	.023
Feb	.076	.009	.128	.012
Mar	.213	.011	.255	.016
Apr	.217	.010	.128	.006
May	.147	.008	.193	.006
Jun	.088	.007	*.072	.006
Jul	.189	.014	*.025	.005
Aug	.102	.011	.152	.012
Sep	.178	.015	.108	.012
Oct	.230	.012	--	--
Nov	.186	.012	*.106	.013
Dec	.270	.015	.264	.015
Annual Mean:		.011		.011

*Less than 400 hours of readings during the month

	Coburn Road - 1981		Coburn Road - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.409	.052
Feb			.342	.043
Mar			.263	.024
Apr			.310	.013
May			.210	.007
Jun			.150	.011
Jul			.227	.012
Aug			.385	.028
Sep	.062	.007	.335	.026
Oct	.410	.032	.331	.033
Nov	.365	.050	.213	.051
Dec	.350	.043	.541	.041
Annual Mean:		.029		.028

Table B-III, Cont.
Billings Area - Sulfur Dioxide
Parts Per Million

	Lockwood Park - 1981		Lockwood Park - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.267	.026
Feb			.228	.034
Mar			.260	.019
Apr			.657	.020
May			.322	.014
Jun			.284	.015
Jul			.400	.018
Aug			.243	.024
Sep	.126	.009	.324	.023
Oct	.313	.028	.278	.024
Nov	.334	.031	.235	.026
Dec	.186	.022	.663	.036
Annual Mean:		.023		.023

	Laurel New Farm - 1981		Laurel New Farm - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.122	.014	.090	.016
Feb	.085	.011	.065	.010
Mar	.108	.009	.077	.007
Apr	.127	.007	.068	.006
May	.061	.007	.110	.005
Jun	.050	.005	.063	.005
Jul				
Aug				
Sep	.064	.005		
Oct	.100	.005		
Nov	.093	.008		
Dec	.133	.010		
Annual Mean:		.008		.008

Table B-III, cont.
Billings Area - Sulfur Dioxide
Parts Per Million

	No. Johnson Lane - 1981		No. Johnson Lane - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.381	.021
Feb			.355	.036
Mar			.216	.014
Apr			.304	.012
May			.220	.008
Jun			.210	.011
Jul			.325	.014
Aug			.425	.021
Sep	.044	.007	.716	.025
Oct	.377	.031	.384	.028
Nov	.417	.036	.250	.029
Dec	.227	.031	.364	.029
Annual Mean:		.026		.023

	Laurel BN - 1981		Laurel BN - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.121	.019
Feb			.129	.014
Mar			.065	.005
Apr			.091	.007
May			.100	.004
Jun			.106	.006
Jul			.203	.007
Aug			.165	.010
Sep	.050	.006	.147	.009
Oct	.167	.014		
Nov	.193	.015		
Dec	.153	.014		
Annual Mean:		.012		.009

Table B-III, Cont.
Billings Area - Sulfur Dioxide
Parts Per Million

	Shawnee Park - 1981		Shawnee Park - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.500	.026	.090	.016
Feb	.258	.020	.065	.010
Mar	.278	.018	.077	.007
Apr	.116	.008	.068	.006
May	.149	.009	.110	.005
Jun	.284	.006	.063	.005
Jul				
Aug	.284	.011		
Sep				
Oct	.234	.025		
Nov	.304	.031		
Dec	.255	.027		
Annual Mean:		.019		.008

	Metra Fairgrounds 1981		Metra Fairgrounds - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.145	.006
Feb			.106	.006
Mar			.174	.007
Apr			.061	.003
May				
Jun				
Jul				
Aug				
Sep				
Oct				
Nov				
Dec	.170	.019		
Annual Mean:		.019		.006

Carbon monoxide was measured at the Fairgrounds (Metra) site during 1982. Table B-IV summarizes one-hour and eight hour maximums, monthly means, and annual averages for CO. There were no readings greater than the Montana eight-hour standard of 9 ppm.

Table B-IV
Billings Area - Carbon Monoxide
Parts Per Million

Billings Metra - Fairgrounds

	1981			1982		
	1-Hour Max	Max 8-hour Mean	Monthly Mean	1-Hour Max	Max 8-hour Mean	Monthly Mean
Jan	10.0	5.3	1.2	17.5	5.25	1.5
Feb	9.4	4.2	.8	10.9	5.34	2.0
Mar	8.1	5.3	.6	8.7	4.78	1.8
Apr	5.9	2.5	.7	12.1	2.11	1.3
May	5.9	2.9	1.2	2.1	1.65	.8
Jun	4.5	2.9	.8	9.0	3.00	1.2
Jul	5.1	4.5	.7	3.1	2.48	1.2
Aug				5.2	2.48	1.0
Sep	6.9	3.7	.7	14.3	3.55	1.1
Oct	9.0	7.1	1.8	9.9	5.50	1.6
Nov	9.0	5.7	2.2	11.5	6.43	1.8
Dec	22.5	8.5	2.3			

Sulfation rate (Table B-V) was analyzed at numerous sites in Yellowstone County. The sulfation rate is a rough indicator of the quantity of sulfur oxides in the air. The advantage of utilizing the sulfation rate method is that numerous samples can be analyzed economically. The readings are a useful tool in determining sulfur dioxide trends in certain areas.

Table B-V
Billings Area - Sulfation Rate
Milligrams Sulfur Trioxide Per 100 Square Centimeters Per Day*

Site	1981 Max	1981 Annual Mean	1982 Max	1982 Annual Mean
Bitterroot	.62	.37	.56	.28
Lockwood School	1.48	.60	1.16	.61
Johnson Lane + Hardin Rd.	1.48	.74	1.09	.51
KGHL Station	.48	.33	.96	.37
City Hall	.42	.23	.47	.21
Garden Avenue	.26	.14	.35	.20
CNR 33 & 2 Ave. N.	.27	.16	.37	.15
Mtn. View Blvd.	.30	.15	.31	.15
1200 Minn. Ave.	.88	.49	.82	.46
5th & S. 28th	.44	.30	.67	.35
Grand Ave. School	.36	.21	.59	.21
S. 27th & 10 Ave. Sl.	.61	.44	1.05	.46
East Conoco	1.01	.57	1.32	.59
Two Moon Park	1.31	.75	1.34	.68
Newman School	.47	.22	.53	.26
Bench School	.36	.20	.36	.18
Klenck Lane	1.31	.71	1.27	.64
Piccolo & N. Ft. Rd.	2.18	1.29	1.58	1.14
Johnson & Lockwood	2.05	.88	1.46	.80
Johnson Rd. N.	2.10	1.07	1.46	.83
Woodland	1.39	.82	.96	.66
Coburn Road	1.38	.85	1.65	.82
Laurel Jr. Hi.	.09	.03	.43	.10
1 Mi. NE Coop	1.02	.47	1.03	.44
3/4 Mi. E. of Coop	.77	.54	.67	.48
St. John's Church	.28	.11	.43	.13
1/2 Mi. S. of Cenex	1.20	.60	.64	.43
E. of Laurel	.92	.62	1.35	.66
Laurel Farm E. Cenex	1.32	.71	1.51	.78
West Coop	.34	.17	.26	.15

*Values in excess of .5 indicate possible trouble spots and warrant continued sampling.

C. BUTTE

C. BUTTE

The Butte study area consists of several sites within Silver Bow County. Butte, at an elevation of 5,200 feet, is surrounded on three sides by the Continental Divide. The surrounding peaks make the area a prime candidate for temperature inversions. Due to Butte's high elevation, summers come late and falls arrive early. Precipitation for Silver Bow County ranges from 12 to 20 inches annually.

Butte-Silver Bow's population fluctuates greatly depending on operational changes in the mining industry. County population dropped 10 percent from 41,981 in 1970 to 37,950 in 1980. Future decreases in population may be seen due to the closure of the nearby copper smelter in Anaconda, and a reduction in the work force at the Berkeley Pit in Butte and planned closures in June 1983.

Major sources include:

1) Open pit copper mine (particulate)

2) Copper ore concentrator (particulate)

3) Elemental phosphorous plant (fluoride, particulate)

4) Tepee burner (fine particulate, CO)

5) Asphalt plants (particulate)

6) Automobiles (NOx, re-entrained particulate)

7) Wood stoves and fireplaces (fine particulate, CO)

Butte area sites are listed on Table C-I and are shown in Figure 1-C.

Table C-II summarizes TSP values for Butte area hi-vols. A portion of Butte was designated as a non-attainment area for TSP in 1978 (see Appendix C).

In 1981 the Greeley School was again above the standard at 78 ug/m^3. In 1982, however, the annual geometric mean fell below the standard, showing a 57 ug/m^3. The TSP monitoring site at the Blaine School was terminated in the fall of 1982.

Table C-I

Butte Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Butte					
Greeley School	Silver Bow	State AQB	Population oriented	Center city - residential	Top of Greeley School Building on South Side
Hebgen Park	Silver Bow	State AQB	Population oriented	Center city - residential	Southeast side of Hebgen Park
Dr. Canty	Silver Bow	State AQB	Population oriented	Suburban - residential	Roof of 225 S. Clark
*Walkerville					
Blaine School	Silver Bow	State AQB	Population oriented	Suburban - commerical	N. Main Street in Walkerville

*Site discontinued in 1982

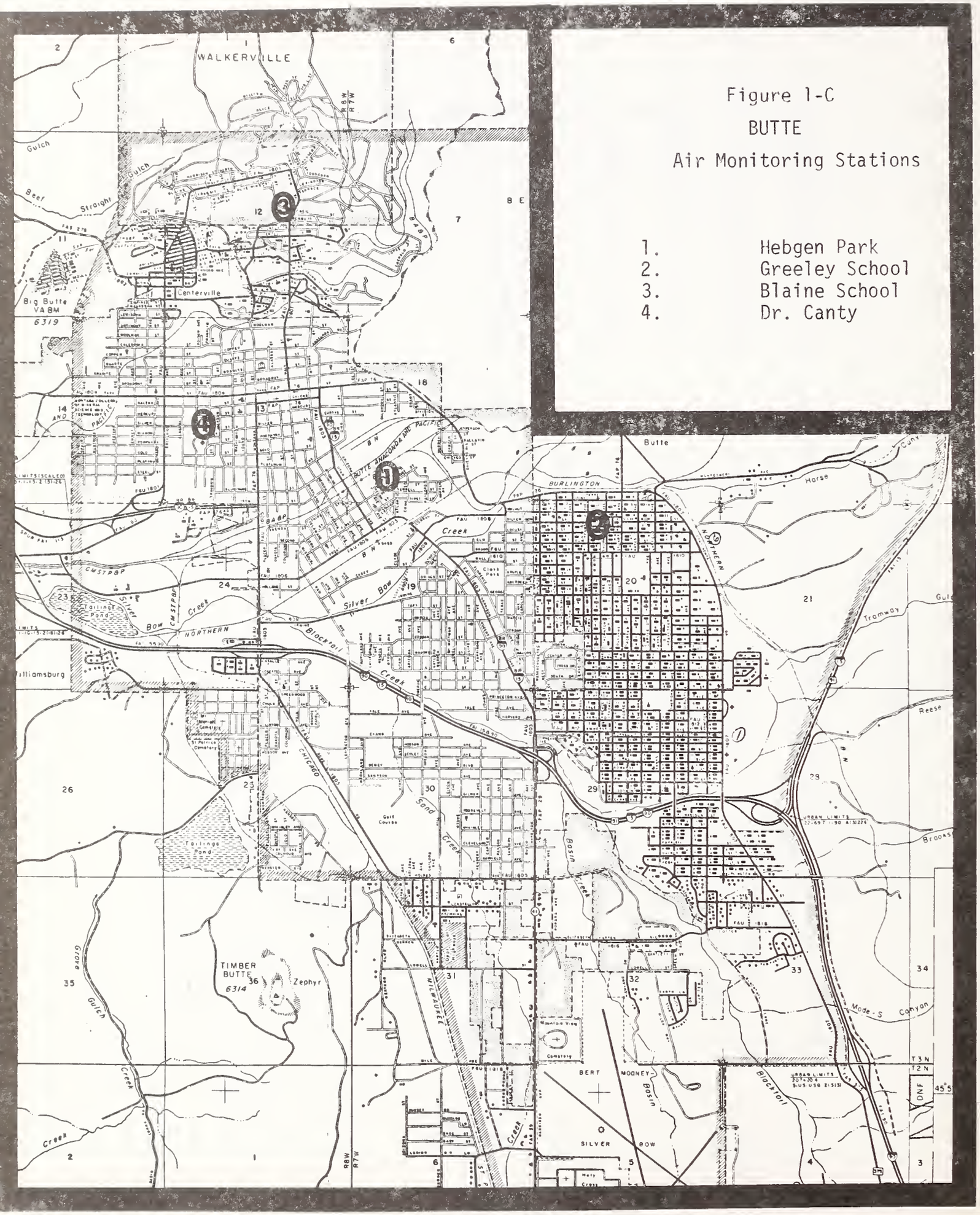


Figure 1-C

BUTTE

Air Monitoring Stations

1. Hebgen Park
2. Greeley School
3. Blaine School
4. Dr. Canty

Table C-II
Butte Area - TSP
Micrograms Per Cubic Meter

Site	1981			1982		
	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Dr. Canty Office	49	245	228	37	158	137
Greeley School	89	346	247	57	225	216
Hebgen Park	65	263	177	47	184	153
Walkerville-Blaine School	30	85	79	21	66	51

The Montana Board of Health and Environmental Sciences approved a vegetation standard for fluorides of 35 micrograms per gram (ug/g) grazing season average with no monthly average exceeding 50 ug/g. Stauffer Chemical Company sampled vegetation during 1982 and the results are in table C-III. There were three violations of the monthly average greater than 50 ug/g and two violations of the grazing season average greater than 35 ug/g.

Table C-III
Fluoride in Vegetation
(ug/g)
Ramsay Area - 1982

		Monthly Ave.		Grazing Season Avg.	
Site	Month	Stauffer Lab	AQB Lab	Stauffer Lab	AQB Lab
Hilderman#5	July	8.7	15		
Hilderman#6		13.4	15.5		
	August	21.7	25.5		
	October	34	35.5		
	November	93.9	83.0	40.8	39.8
Tamietti #7	July	6	10.5		
	October	25.3	31.0		
	November	100	90.5	46.4	44
Tamietti #8	July	7.6	11		
	October	9.2	11.5		
	November	24.5	28.5	13.8	17
Erickson #9	November	67.9	59.5		

Butte area winds tend to be light (6 mph or less) and circular in pattern, a factor which contributes significantly to the high incidence of temperature inversions.

D. EASTERN MONTANA

D. EASTERN MONTANA

Eastern Montana air monitoring sites are generally considered those sites east of Billings. The data collected at Scobey as part of the Poplar River Project is presented in a later chapter. Table D-I lists the eastern Montana sites; Figure 1-D shows site locations.

The Jordan site is primarily used to collect background data. Miles City, Sidney and Glendive sites are located to monitor urban particulate levels. The broad expanse of the area is primarily used for agricultural purposes and is sparsely populated. The elevations range from 2500 to 3500 feet. The climate tends to be harsh, with long cold winters and hot dry summers.

Pollution sources include:

1) Agriculture (particulate)

2) Coal development and mining (particulate)

3) Coal-fired power plants at Colstrip and Sidney (particulate, NOx, SO_2)

4) Gas sweetening plants (SO_2)

5) Oil well flares and vents (SO_2, H_2S)

6) Sugar beet refinery (particulates)

The Bureau of Land Management contracted the AQB to operate four hi-volume samplers in Montana which were at Monida Pass, Jordan, Plevna, and Malta; see Figure 2-D. The objective was to obtain TSP data on their jurisdictional lands. In the event of any future development either coal, oil or gas, there will be some established baseline TSP data available.

After the BLM finished their one-year study, the AQB took over one site. The BLM site at Jordan was chosen for its remote status in place of the Lindsay site.

Figure I-D
EASTERN MONTANA
Air Monitoring Sites

1. Miles City PCA
2. Glendive Dawson Community College
3. Glendive/Medical Arts Center
4. Jordan
5. Plevna/BLM
6. Malta/BLM
7. Sidney

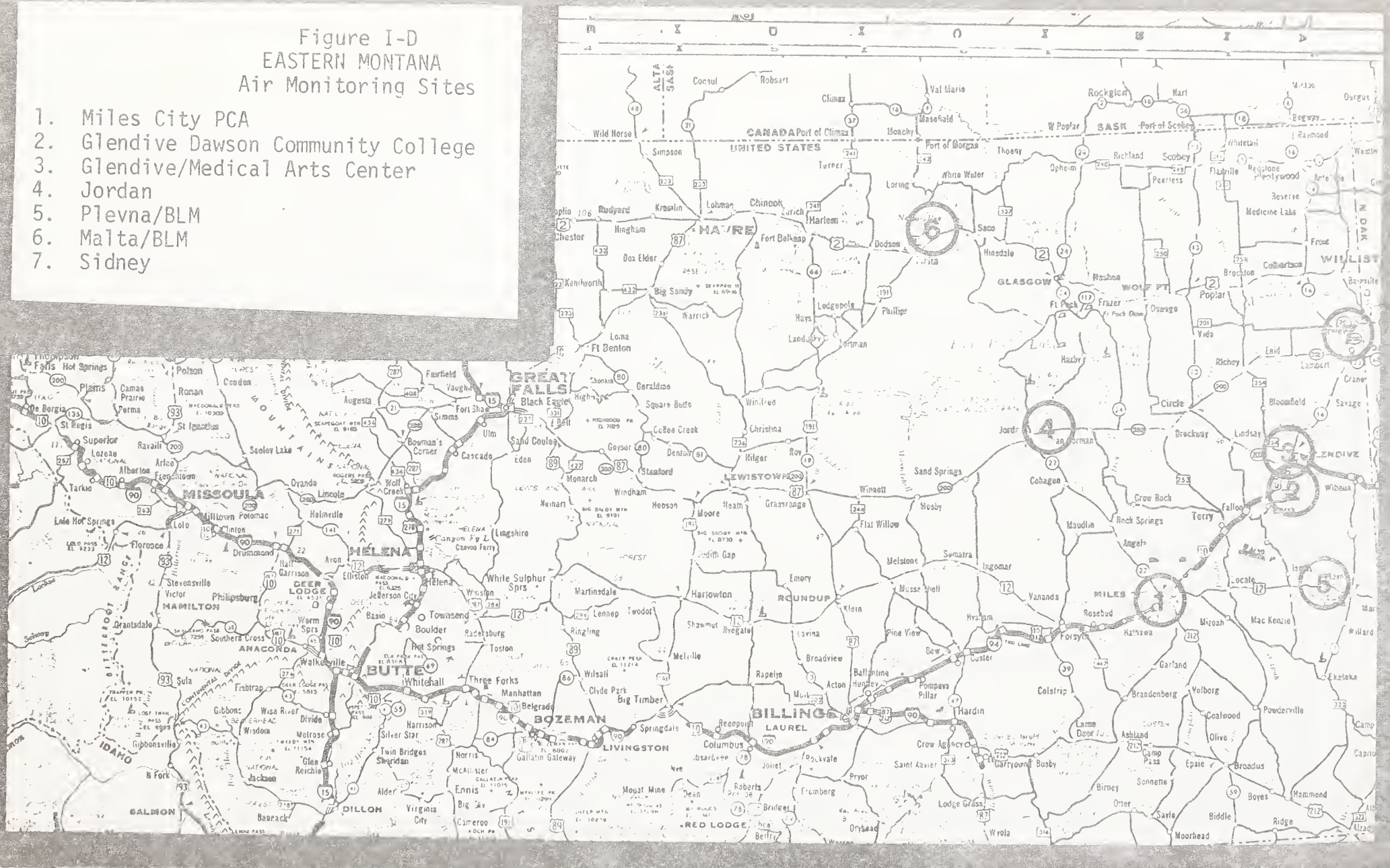


Table D-I

Eastern Montana Area
Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Miles City PCA Building	Custer	State AQB	Population	City center - commercial	PCA Building
Glendive *Dawson Comm. College	Dawson	State AQB	Background	Rural-near urban	Roof of Administration Building
Glendive **Med. Art Center	Dawson	State AQB	Population	City center - commercial	Roof Medical Arts Bldg.
Jordan	Garfield	State AQB	Background	Rural-agricultural	12 miles east of Jordan North side of State Route 20
Plevna	Fallon	BLM/AQB	Background	Rural-near urban	Downtown Plevna
Malta	Phillips	BLM/AQB	Background	Rural-agricultural	Bowdoin Wildlife Refuge

*Shut down in November 1982
**Started November 1982

E. GREAT FALLS

E. GREAT FALLS

The Great Falls study area includes all sites in Cascade County. The county is located in the transition zone between the Rocky Mountains and the Northern Great Plains. As a consequence, it has climatic conditions common to both regions.

Great Falls is situated at the confluence of the Sun River with the Missouri River at an elevation of 3,300 feet. The city tends to be windy, with cold winters and hot summers. Temperature inversions are not as common as in the western valleys, but do occur.

Population counts decreased from 1970 to 1980 for both Cascade County and Great Falls. Cascade County decreased one percent from 81,804 to 80,639 while Great Falls decreased six percent from 60,091 to 56,105.

Table E-I lists monitoring sites for the Great Falls area; figure 1-E locates sites on a map of Great Falls.

Air pollution sources include:

1) Two grain mills (fine particulate)

2) An oil refinery (hydrocarbon, SO_2)

3) A copper refinery* (particulates)

4) Automobiles (NOx, CO, lead)

5) Home heating devices (fine particulate, CO, HC)

*The copper refinery was shut down in September 1980 as part of the closure of the copper smelter in Anaconda; however, on-going demolitions may cause emissions.

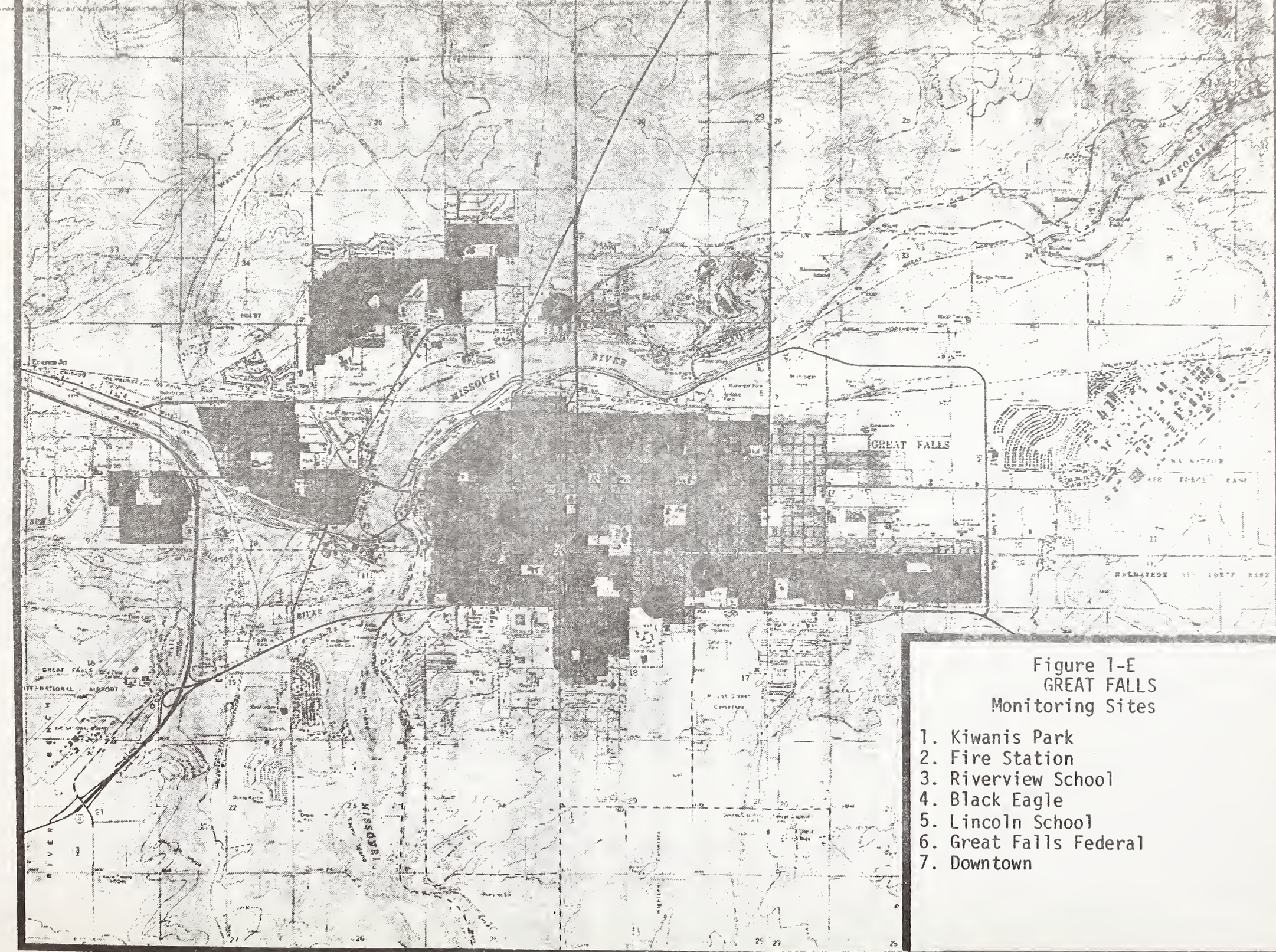


Figure 1-E
GREAT FALLS
Monitoring Sites

1. Kiwanis Park
2. Fire Station
3. Riverview School
4. Black Eagle
5. Lincoln School
6. Great Falls Federal
7. Downtown

Table E-I
Great Falls Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Great Falls					
**Kiwanis Park	Cascade	State AQB	Population-oriented	Center city-residential	Park bounded by 25th, 23rd street and 5th and 6th avenue
Fire Station #1	Cascade	*CCAPC	Population-oriented	Center city-residential	9th Street and First Avenue South
**Riverview Sch.	Cascade	*CCAPC	Population-oriented	Suburban-residential	Riverview School - 100 Smelter Avenue
Black Eagle	Cascade	*CCAPC	Population-oriented	Center city - commercial	Roof of Black Eagle Post Office
**Lincoln School	Cascade	*CCAPC	Population-oriented	Suburban - commercial	625 27th Street
GF Federal	Cascade	*CCAPC	Source oriented	Suburban - commercial	Back of GF Federal Parking Lot-10th Ave. So.
Downtown	Cascade	*CCAPC	Source oriented	Center city - commercial	Roof of City Library 301 2nd Avenue North

*CCAPC - Cascade County Air Pollution Control
**Shut down September 1982

Table E-II provides a summary of TSP data for Great Falls. No sites were in violation of the federal primary standards. The Fire Station site had the highest annual average of 67 ug/m^3 in 1982. Three sites were shut down in 1982; these were Lincoln School, Riverview, and Kiwanis Park.

Table E-II
Great Falls Area - TSP
Micrograms Per Cubic Meter

Site	1981			1982		
	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
GF - Black Eagle	58	166	142	64	216	144
GF - Fire Station	69	291	192	67	204	180
GF - Downtown	55	200	127	49	107	107
GF - CCHD	*43	157	87			
Kiwanis Park**	43	131	117	39	87	75
GF - Lincoln School**	48	164	128	44	124	99
GF - Riverview**	45	141	124	40	120	109

*Less than eight months of data
**Shut down in 1982

Carbon monoxide was measured at the Great Falls Federal site on 10th Avenue South. Table E-III lists the highest one-hour and eight-hour concentrations and monthly means for the Great Falls Federal site.

Table E-III
Great Falls Area - Carbon Monoxide
Parts Per Million

	Great Falls Federal - 1981			Great Falls Federal - 1982		
	1-Hour Max	Max 8-hour Mean	Monthly Mean	1-Hour Max	Max 8-hour Mean	Monthly Mean
Jan	8.7	7.8	2.2			
Feb	6.3	4.8	1.4			
Mar	5.7	4.3	1.6			
Apr	4.5	2.9	.9	3.2	2.0	.7
May	2.1	1.6	.5	4.7	1.3	.7
Jun	2.5	2.2	.5	2.5	1.4	.7
Jul	2.6	2.0	.5	2.3	1.0	.6
Aug	3.6	2.1	.6	2.7	1.8	.6
Sep	4.2	2.2	.4	6.3	2.6	.6
Oct	4.8	2.3	.8	6.5	3.1	1.0
Nov	7.1	4.0	.9	9.7	5.4	1.0
Dec	10.5	7.4	1.3	6.0	4.1	1.2

F. HELENA
EAST HELENA

F. HELENA-EAST HELENA

The Helena-East Helena study area includes monitoring activities in Lewis and Clark and Jefferson Counties. Helena and East Helena are located at the southern end of the Helena Valley. The valley, approximately 40 miles in width and 4100-4300 feet in elevation, is bordered by mountain ranges on all sides. The cities of Helena and East Helena, like other cities in mountainous areas, are subject to frequent temperature inversions in winter months.

The area population rose 29 percent from 1970 to 1980 (Lewis and Clark County up 29 percent, 33,281 to 43,053; Helena up five percent, 22,730 to 23,818; East Helena down 0.5 percent, 1,651 to 1,643).

The area's monitoring sites are located on Figures 1-F and 2-F and listed on Table F-I.

Pollution sources in the area include:

1) Primary lead smelter (lead, particulate, SO_2)

2) Copper oxide, zinc oxide manufacturer (Heavy metals, particulates)

3) Automobiles (NOx, CO, lead, re-entrained particulate)

4) Woodstoves and fireplaces (fine particulate, CO, organic HC)

Table F-II provides a summary of TSP data for Helena and East Helena. None of the sites which recorded a complete year of data registered an annual average for TSP in excess of the federal primary standard.

The number of monitors in East Helena was reduced from eleven to five after the lead study ended approximately mid-way through 1982. The data from the early part of the year was used in the special lead study around the East Helena smelter. These data are available upon request from the Air Quality Bureau.

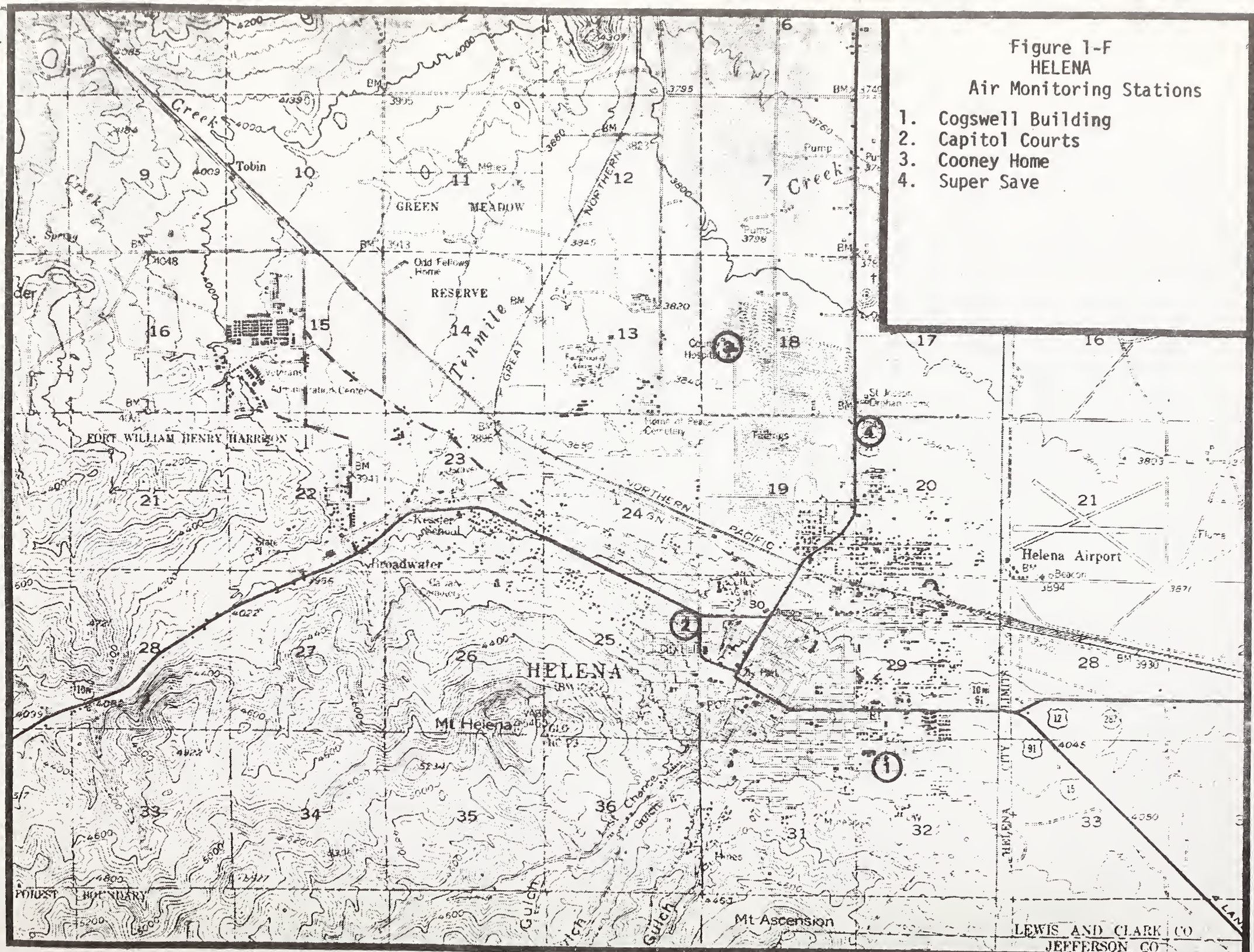


Figure 1-F
HELENA
Air Monitoring Stations
1. Cogswell Building
2. Capitol Courts
3. Cooney Home
4. Super Save
HELENA
Mt Helena
Mt Ascension
GREEN MEADOW
RESERVE
FORT WILLIAM HENRY HARRISON
Broadwater
Helena Airport
Tobin
Old Fellows Home
Kessler School
NORTHERN PACIFIC
GREAT NORTHERN
Tenmile Creek
LEWIS AND CLARK CO
JEFFERSON CO
CITY LIMITS
FOREST BOUNDARY

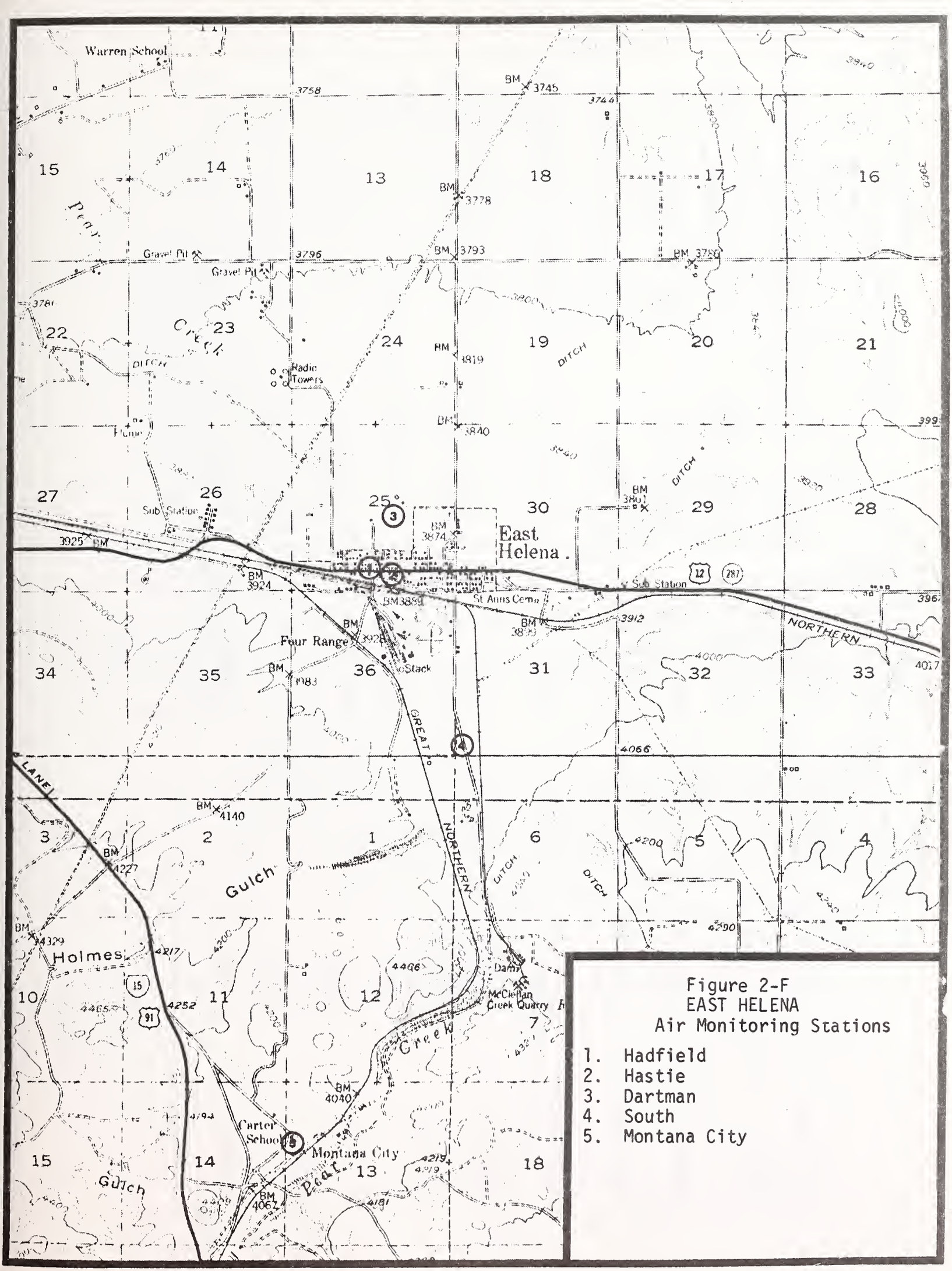


Figure 2-F
EAST HELENA
Air Monitoring Stations

1. Hadfield
2. Hastie
3. Dartman
4. South
5. Montana City

Table F-1

Helena-East Helena Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Helena					
Cogswell Building	Lewis & Clark	State AQB	Population oriented	Center city - residential	Roof of Cogswell Building, Lockey & Sanders Streets
Capital Courts	Lewis & Clark	L&C Health	Special study	Center city - residential	Roof of Capital Courts on Dearborn Avenue
Super Save	Lewis & Clark	L&C Health	Special study	Suburban-commercial	Custer and Montana, Northgate Plaza
Cooney Home	Lewis & Clark	L&C Health	Special study	Suburban-commercial	Custer and Montana, Northgate Plaza
East Helena					
Hastie	Lewis & Clark	State AQB	Source oriented	Center city - residential	212 E. Pacific Street
Hadfield	Lewis & Clark	ASARCO-AQB	Source oriented population	Center city - residential	101 W. Main, East Helena
Dartman	Lewis & Clark	ASARCO-AQB	Source oriented	Suburban - residential	.5 mi N. of East Helena
South	Lewis & Clark	ASARCO-AQB	Source oriented	Rural - agricultural	1 mi S. of East Helena
Montana City	Jefferson	AQB	Source and population oriented	Suburban - residential	On Montana City School

Table F-II
Helena-East Helena - TSP
Micrograms Per Cubic Meter

Site	1981 Geo. Mean	1981 1-High	1981 2-High	1982 Geo. Mean	1982 1-High	1982 2-High
Helena Super Save				58	188	166
Helena Cooney Home				*31	75	70
Helena-Cogswell	40	191	121	42	114	113
Helena-Capital Courts	52	248	220	51	183	166
E. Helena-Hadfield	*80	242	203	*61	133	121
E. Helena-Hastie	67	230	209	*56	102	101
E. Helena-Dartman	*44	112	107	*37	85	83
E. Helena-South	*39	115	102	*38	88	80
E. Helena-Montana City	*73	422	240	*73	188	182

*Less than eight months of data

Table F-III lists metal data obtained by chemical analyses of hi-vol filters from the East Helena area. Metal data is obtained by atomic absorption analysis and ICAP. In 1982 the lead concentration concentration at the East Helena Hadfield site was the highest of all samplers in the state's network. Quarterly averages for lead from the Hastie, Hadfield and Dartman sites exceed the Federal standard of 1.5 ug/m^3 for a calendar quarter. The annual concentrations of arsenic and cadmium in East Helena are also the highest in the state; there are no standards for these metals. The ASARCO lead smelter is probably the largest contributor with other sources being American Chemet and re-entrained dust.

Helena area winds are predominantly from the northwest through the southwest. Often during the winter months, the winds do not have sufficient velocity to blow out pollutants trapped in the valley by temperature inversions.

Table F-III

Helena-East Helena Area - Metals
Micrograms Per Cubic Meter

Site		1981 Mean	1981 1 High	1981 2 High		1982 Mean	1982 1 High	1982 2 High
Hastie	As(3)	.313	1.249	.720	(3)	.233	.510	.444
	Cd(3)	.205	.648	.532	(3)	.188	1.23	.359
	Cu(3)	3.66	12.69	10.62	(3)	2.06	9.75	4.72
	Pb(12)	2.34	13.70	10.70	(5)	2.18	5.20	4.08
	Zn(3)	1.69	3.83	3.50	(3)	.84	1.52	1.52
South	As(3)	.108	.456	.360	(3)	.090	.256	.171
	Cd(3)	.098	.498	.308	(3)	.040	.156	.049
	Cu(3)	.52	2.82	2.51	(3)	.41	1.13	.52
	Pb(8)	1.16	6.09	5.69	(5)	1.30	4.28	3.45
	Zn(3)	.54	2.44	1.54	(3)	.31	.72	.69
Hadfield	As(3)	.161	.432	.432	(3)	.207	.688	.340
	Cd(3)	.170	.826	.527	(3)	.097	.270	.198
	Cu(3)	3.04	13.94	10.57	(3)	2.06	10.41	3.65
	Pb(4)	3.22	10.10	7.83	(5)	2.54	7.62	6.18
	Zn(3)	1.01	3.35	2.28	(3)	.85	3.06	1.97
Dartman	As(5)	.170	.840	.480	(3)	.126	.343	.301
	Cd(5)	.163	.899	.677	(3)	.093	.271	.267
	Cu(5)	2.43	11.52	9.39	(3)	.94	4.16	4.07
	Pb(5)	1.87	13.74	5.90	(5)	1.67	3.73	3.35
	Zn(5)	1.02	4.70	2.37	(3)	.42	1.46	.75
Montana City	Pb(3)	.12	.48	.33	(5)	.14	.41	.33

() - parentheses denotes number of sample months

G. MISSOULA

G. MISSOULA

The Missoula study area centers around the city of Missoula and is contained within Missoula County. The city is located at the confluence of the Clark Fork and Bitterroot Rivers at an elevation of 3,200 feet. The Missoula Valley floor forms a deep pocket with the surrounding mountains: Bitterroot Range to the west and southwest; Sapphire Mountains to the southeast, and the Reservation Divide to the north. The area is subject to severe temperature inversions during winter months which trap pollutants and allow concentrations to build up in the valley.

Population for the area increased substantially from 1970 to 1980; Missoula County increased 29 percent from 58,263 to 75,432, while the city increased 10 percent from 29,497 to 32,841. This dramatic increase influences Missoula Valley pollution problems.

Table G-I lists Missoula area air monitoring sites and Figure 1-G shows site locations.

Major sources in the area include the following:

1) Kraft paper mill (particulates, H_2S, other sulfur compounds)

2) One plywood plant (fine particulate and hydrocarbons)

3) Particle board plant (fine particulate, hydrocarbons)

4) Three sawmills (particulate)

5) Automobiles (NOx, CO, re-entrained particulate)

6) Woodstoves and fireplaces (CO, fine particulate and hydrocarbons)

Table G-1
Missoula Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Missoula					
Courthouse Roof	Missoula	**MCCHD	Population oriented	Center city - commercial	City-County Courthouse-Corner of Woody Street & W Pine
Rose Park	Missoula	**MCCHD	Population oriented	Center city - residential	NE Side Sunset Memorial Park - 1/2 blk from Hiway 93S
Malfunction Jct. S.E.	Missoula	State AQB	Population oriented	Center city - mobile	Junction of Brooks, Russell & South Avenue
Missoula County HW#1	Missoula	**MCCHD	Source oriented	Rural-industrial	Railroad bluff near Hoerner Waldorf
Missoula County HW#2	Missoula	**MCCHD	Source oriented	Rural-industrial	Well Field
Boyd Park	Missoula	**MCCHD	Population oriented	Suburban-residential	Washburn and Ernest Avenue
Missoula Lolo	Missoula	**MCCHD	Population oriented	Suburban-residential	14 miles So. of Missoula
Missoula Northside	Missoula	**MCCHD	Population oriented	Suburban residential	Missoula City cemetary

**MCCHD - Missoua City-County Health Department

Figure 1-G
MISSOULA
Air Monitoring Station

1. Courthouse Roof
2. Rose Park
3. Malfunction Junction
4. Boyd Park
5. Lolo
6. Northside

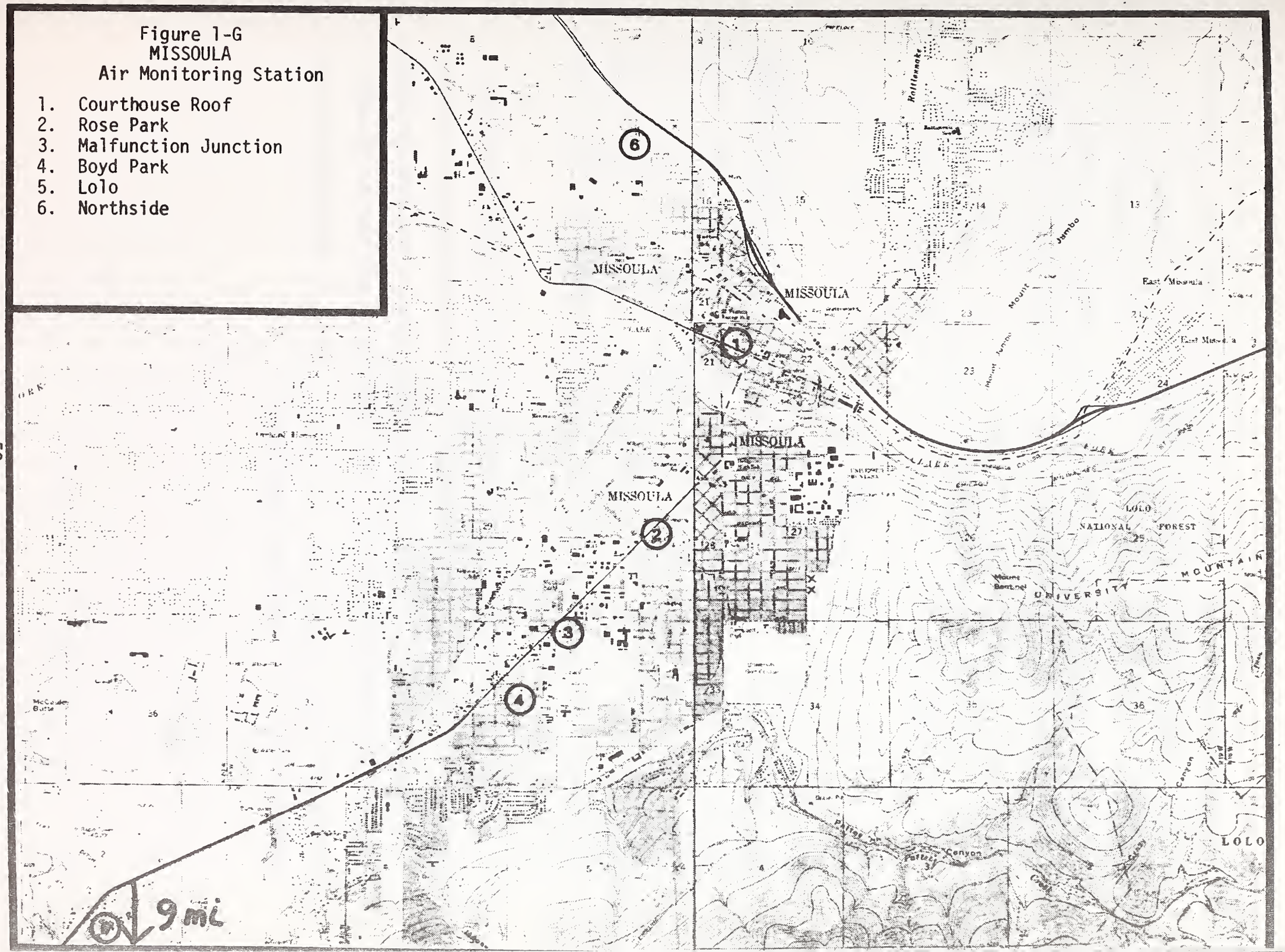


Table G-II summarizes TSP data for the Missoula hi-vol sites. Missoula has consistently had some of the highest TSP readings in the state. In 1977 Missoula was designated non-attainment for TSP (see Appendix C). This was due to high readings (in excess of the Federal 24-hour standard of 260 ug/m^3) throughout the year. 1981 was the first year since 1975 that all sites with sufficient data showed annual averages below the Federal primary standard (75 ug/m^3). The 1982 data show a continuation of the downward trend. Two sampler units at Lolo and on the North side of Missoula were installed in 1982.

Table G-II
Missoula Area - TSP
Micrograms Per Cubic Meter

	1981			1982		
Site	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Courthouse Roof	62	220	216	55	256	216
HW #1	25	106	96	26	102	86
HW #2	25	122	100	26	109	105
Boyd Park	*81	195	160	72	319	309
Rose Park	56	208	187	52	381	312
Lolo				*47	90	85
Northside				*58	138	127

*Less than eight months data

In addition to measuring particulate matter with hi-vols and dichotomous samplers, Missoula county uses an aerosol mass monitor (beta counter) to give real time hourly readings of particulate concentrations. This data corresponds fairly well with RP and TSP and is used by county personnel for episode monitoring when high readings occur. No summary of this data is presented in this report; however, it is available upon request.

Missoula sulfate data are presented in Table G-III. Chemical analysis methods are used to obtain this data from hi-vol filters. Sulfate levels in Missoula do not appear to be influenced by the kraft pulp mill. The levels at the HW#1 and HW#2 sites, however, are elevated for a rural area, probably due to the nearby kraft pulp mill.

Table G-III
Missoula Area - Sulfate
Micrograms Per Cubic Meter

	1981			1982		
Site	Mean	1-High	2-High	Mean	1-High	2-High
Courthouse Roof	2.9(6)	6.5	5.9	3.5(12)	10.6	7.4
Rose Park	2.1(3)	6.5	5.4	2.6(12)	9.8	7.7
HW#1	3.7(2)	8.6	5.9	2.3(12)	16.5	9.2
HW#2	2.6(2)	5.8	4.9	1.9(12)	8.7	7.6

( ) - parentheses denotes number of sample months.

Part of the city of Missoula was designated non-attainment for CO due to high concentrations in the past (see Appendix C). Sampling of CO was conducted at two sites in 1982. Malfunction Junction site showed violations of the eight-hour 9 ppm standard. These high CO concentrations are usually due to automobile emissions. In recent years, Missoula has recorded CO levels in residential areas, with Boyd Park exceeding the eight-hour standard. This is probably due to an increased use of wood burning devices in homes. Table G-IV presents the CO data for the Missoula area. The Boyd Park site is only operated from August to May.

Table G-IV
Missoula Area - Carbon Monoxide
Parts Per Million

Month	Malfunction Junction - 1981 1-hour Max	Max 8-hour Mean	Monthly Mean	Malfunction Junction - 1982 1-hour Max	Max 8-hour Mean	Monthly Mean
Jan	11.8	9.2	3.4	12.7	12.0	3.5
Feb	12.3	11.7	2.9	11.3	9.1	3.6
Mar	8.0	6.6	2.9	6.8	5.6	2.7
Apr	7.8	7.0	2.5	5.5	4.0	2.3
May	7.8	6.4	3.0	19.9	7.4	2.2
Jun	7.5	6.9	3.6	5.0	3.5	1.7
Jul	6.5	6.2	3.3			
Aug	4.3	3.0	.9			
Sep	4.5	3.1	1.2			
Oct	8.0	5.1	1.2	7.6	6.2	2.6
Nov	9.5	7.3	2.5	13.7	11.2	3.5
Dec	7.3	6.6	4.1	17.8	15.0	3.6

Month	Boyd Park - 1981 1-Hour Max	Max 8-hour Mean	Monthly Mean	Boyd Park - 1982 1-Hour Max	Max 8-Hour Mean	Monthly Mean
Jan				10.6	9.2	2.5
Feb				13.4	8.4	2.5
Mar				9.0	1.4	0.6
Apr				3.4	2.1	0.7
May				1.4	.3	0.1
Jun						
Jul						
Aug	3.1	2.3	1.2			
Sep	4.0	3.0	.8			
Oct	14.3	4.5	1.2			
Nov	11.7	8.5	2.3			
Dec	10.9	7.5	2.3			

Wind in Missoula tends to be southwesterly most of the year. It is generally of low speed (1-2 m/sec) and unable to break up temperature inversions.

Sulfur dioxide was monitored again during the winter months at the Rose Lawn Park site. A summary of the SO_2 data is in Table G-V. There was no significant amount of SO_2 detected.

Table G-V
Missoula Area - Sulfur Dioxide
Parts Per Million

1982

Month	Hourly Max.	Monthly Mean
Jan		
Feb		
Mar		
Apr		
May		
Jun		
Jul		
Aug		
Sep		
Oct		
Nov	.011	.002
Dec	.015	.001
Annual Mean:		.002

H. NORTHWESTERN MONTANA

H. NORTHWESTERN MONTANA

The Air Quality Bureau's activities in Northwestern Montana center around the Flathead River Basin Environmental Impact Study. Several sites are operated in Flathead and Lake Counties as part of this project; another site is located in Libby. Table H-I lists the air monitoring sites; Figure 1-H shows the site locations. Figure 2-H shows the Flathead River Basin Study area.

The Flathead Study was authorized by Congress and funded through the Environmental Protection Agency. Air quality is only one portion of the study; other parts include studies of limnology, sedimentation, fisheries, recreation, riparian habitat and soil permeability. The study will be completed June 30, 1983.

The air quality portion of the study was precipitated by developments which might affect air quality in Glacier National Park and the Flathead Valley. The developments include the following:

1) U.S. and Canadian industrial development and mining operations -- particularly the Cabin Creek coal mine in British Columbia;

2) Population and recreational growth--In 1980 Kalispell's population decreased slightly to 10,299 from 10,526 in 1970, while Flathead County increased by 30 percent from 39,460 in 1970 to 51,462 in 1980.

The topography of the Flathead and Libby Valleys is very similar to the Missoula Valley. The inhabited areas, around 3000 feet in elevation, are surrounded by mountains reaching 8-10,000 feet. As a result temperature inversions and poor ventilation are common; this is especially evident during the winter months.

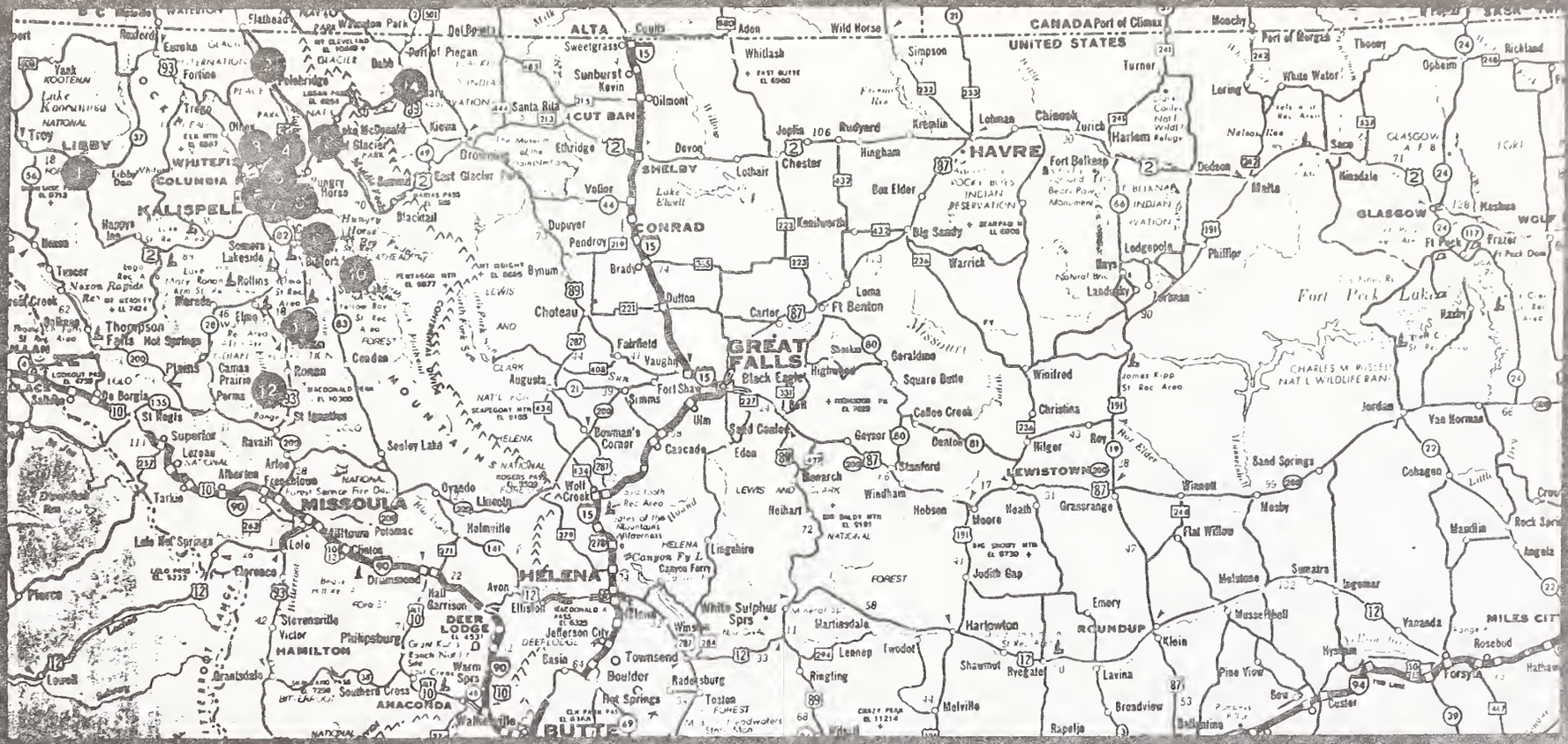


Figure 1-H
NORTHWESTERN MONTANA
Air Monitoring Stations

1. Libby-Brown
2. Polebridge
3. Whitefish
4. Columbia Falls-NAAC
5. Columbia Falls-Anders
6. Glacier Int. Airport
7. Kalispell-Evergreen
8. Kalispell-Evergreen
9. Big Fork
10. Swan River
11. Polson
12. Ronan-Ninepipe
13. West Glacier Fire St.
14. St. Marys

Table H-I

Northwestern Montana - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Libby Brown Residence	Lincoln	State AQB	Population oriented	Center city - residential	Corner of Larch & Dakota - 1/2 Block from St. Regis & 4 lane paved road
Polebridge	Flathead	State AQB	Special project	Remote	Polebridge Ranger Station in Glacier Park
Whitefish	Flathead	State AQB	Special project	Suburban-residential	In the city Park at Pine & 3rd
Columbia Falls NAAC	Flathead	State AQB	Source oriented	Rural - agricultural	1/2 mi NW of Anaconda Alum.
Anders	Flathead	State AQB	Population oriented	Center city - residential	726 First Avenue East
Glacier Int. Airport	Flathead	State AQB	Special project	Rural-agricultural	Near airport headquarters
Kalispell Evergreen	Flathead	State AQB	Special project	Suburban-residential	Evergreen Rural Cooperative Bldg.
Universal Athletic	Flathead	State AQB	Population	Center city - commercial	Roof of Universal Athletic Supply - 226 Main Street
Big Fork	Flathead	State AQB	Special project	Suburban - residential	Big Fork Ranger Station W. side of Hwy 35
Swan River	Lake	State AQB	Special project	Remote	Swan River Youth Camp 15 mi S of Swan Lake
Polson	Lake	State AQB	Special project	Rural - agricultural	2 mi E of Polson near Hwy 93

Table H-I, Cont.

Northwestern Montana - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Ronan Ninepipe	Lake	State AQB	Special project	Rural - agricultural	1 mi S of Ronan near Hwy 93
West Glacier	Flathead	State/GNP	Special Project	Remote	Fire Weather Station
St. Mary's	Glacier	State/GNP	Special Project	Remote	St. Mary's Ranger Station

Sources of pollution by county include the following:

Flathead County

1) Aluminum reduction plant (fluoride, particulates, SO_2)
2) Two plywood plants (particulates, HC)
3) Particle Board Plant (particulates, HC)
4) Several sawmills (particulates, CO)
5) Four asphalt plants (particulates)

Lake County

6) Two sawmills (particulates, CO)

Lincoln County

7) Plywood plant (particulates, HC)
8) Two sawmills (particulates, CO)
9) Copper- Silver copper mine (particulates)
10) Vermiculite mine and processing plant (particulates)

All Counties

10) Automobile (particulates, CO)
11) Slash and open burning (particulates, CO)
12) Residential wood combustion (particulates, CO)

Table H-II summarize TSP levels in this portion of the state. The Libby site recorded the highest annual average in the state (92 ug/m^3). The Libby site violated both the Federal 24-hour and annual standards during 1982. Sites in Columbia Falls and Kalispell were also above the Federal annual standard of 75 ug/m^3 in 1981 but in 1982 they both dropped below the standard.

Table H-II
Northwestern Montana - TSP
Micrograms Per Cubic Meter

	1981			1982		
SITE	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Big Fork	28	109	84	25	80	78
Ronan-Ninepipe	18	142	55	13	71	54
Polson	36	174	111	36	100	95
Glacier Int. Airport	32	134	103	24	94	89
Flathead - NAAC	25	89	83	14	49	45
Kalispell - Evergreen	53	170	159	44	176	176
Kalispell - Univ. Athletic	81	211	186	73	234	232
Libby - Brown	120	444	378	92	346	282
Col. Falls - Anders	108	494	390	66	241	225
GNP - #5 West Glacier	13	69	59	12	51	46
GNP - #8 St. Mary's	* 6	23	20	* 5	44	18
Swan River	* 6	6	6	23	306	236
Whitefish	*67	144	128	49	138	130
Polebridge	25	89	62	14	89	60

*Less than eight months data

Fluoride is emitted by the ARCO aluminum plant near Columbia Falls and is measured in the Columbia Falls and Glacier National Park areas (Table H-III). The Montana State Board of Health and Environmental Sciences has approved a vegetation standard for fluoride of 35 micrograms per gram (ug/g) average with no monthly average to exceed 50 ug/g. Table H-IV shows the results of the fluoride vegetation sampling around the ARCO aluminum smelter. The samples were taken by ARCO personnel according to AQB fluoride vegetation sampling protocol and a split was sent to the AQB lab for comparison analysis. There were no violations detected during 1982. Although previous sampling methods (calcium formate papers and sodium formate plates) are not applicable to the new standard, they do indicate high ambient levels.

Table H-III
Northwestern Montana - Fluorides
Calcium Paper-Micrograms/Sq. Cm - 30 Days

	1981		1982	
Site	Max	Mean	Max	Mean
Fierstein	.22	.11	.25	.13
RE Owens	.19	.11	.18	.09
Badrock Substation	.28	.17	.25	.14
Dehlbom Field	.54	.23	.46	.23
Anaconda South	6.09	1.62	3.60	1.40
Teakettle Mtn #1	1.04	.65	1.17	.59
Teakettle Mtn #8	.22	.12	1.27	.24
Aluminum City	1.33	.32	2.40	.44
NAAC	.42	.19	.42	.20

Sulfates and nitrates (Table H-V) are measured by chemical analysis of high volume filters. These parameters serve as indicators of gaseous pollutants--sulfate of SO_2 and SO_3 and nitrate of NO, NO_2, and NO_3.

Table H-IV
Fluoride in Vegetation (ug/g)
Columbia Falls Area 1982

Site	Month	Monthly Avg. ARCO Lab	Monthly Avg. AQB Lab	Grazing Season Avg. ARCO Lab	Grazing Season Avg. AQB Lab
Doane	June	6.0	3.0		
	July	7.0	8.0		
	August	8.0	5.0		
	September	10.0	6.0		
	October	11.0	18.0	8	8
Hoffman	June	6.0	3		
	July	11.0	8		
	August	7.0	4	8	5
Liddle	June	10.0	5		
	July	9.0	8		
	August	11.0	9		
	September	15.0	11	11	8

Table H-V
Northwestern Montana Sulfates & Nitrates
Parts Per Million

Site		1981 Mean	1981 1-High	1981 2-High	1982 Mean	1982 1-High	1982 2-High
Polebridge	NO_3	.1(8)	.4	.3	.2(11)	.5	.5
	SO_4	3.2(8)	4.9	4.9	3.0(11)	6.5	5.7
Big Fork	NO_3	.7(12)	3.0	2.8	.5(10)	2.0	1.8
	SO_4	2.4(12)	6.5	5.1	2.0(10)	7.8	6.6
Whitefish	NO_3	1.0(5)	2.0	1.7	.9(12)	3.0	2.4
	SO_4	2.5(5)	4.7	4.3	1.9(12)	6.2	5.9
Kalispell Universal Athletics	NO_3	1.1(12)	3.8	3.7	.7(12)	3.4	3.3
	SO_4	4.2(12)	8.0	7.9	1.1(12)	6.6	6.3
Lake - Polson	NO_3	.9(12)	3.8	3.4	.9(12)	2.8	2.6
	SO_4	2.7(12)	6.6	6.2	2.4(12)	7.2	7.0
Ronan-Ninepipe	NO_3	.8(12)	3.4	3.0	.7(12)	3.4	3.3
	SO_4	1.6(12)	4.9	4.4	1.1(12)	6.6	6.3
Swan River	NO_3	.0(1)	.0	.0	.1(12)	.5	.4
	SO_4	1.9(1)	2.1	1.8	2.7(12)	6.5	5.6
Glacier Int. Airport	NO_3	.9(12)	3.1	3.0	0.9(12)	3.9	3.2
	SO_4	2.5(12)	6.6	5.9	2.1(12)	10.7	6.6

() - parentheses denotes the number of sample months

Visibility was measured at Glacier International Airport and Ninepipe. The standard (3×10^{-5}/meters) applies only to mandatory Class I attainment areas which include national parks and wilderness areas. It equates roughly to being able to see objects clearly at a minimum distance of 60 miles. The data is summarized in Table H-VI. There is no state standard for visibility outside of Class I areas, and the state air quality rules do not apply within the confines of any tribal reservations that are now or will redesignate to a Class I area.

For a more comprehensive analysis of the data from this area, a copy of the Flathead River Basin EIS Interim Annual Report, May 1983, can be obtained from the Bureau.

Table H-VI
Glacier International Airport
Integrating Nephelometer
B-Scat $10^{-5}m^{-1}$

	1981		1982	
Month	Hourly Max.	Monthly Mean	Hourly Max.	Monthly Mean
Jan	21.2	10.9	33.9	6.7
Feb			36.4	6.7
Mar			17.3	3.0
Apr			30.3	3.4
May	20.2	4.4	8.2	1.9
Jun	7.7	2.1	16.2	3.1
Jul	23.5	4.8	19.8	3.3
Aug	25.9	5.4	12.6	2.4
Sep	31.4	3.3	21.6	3.1
Oct	39.8	9.5	55.4	7.2
Nov	53.5	11.6	38.4	6.3
Dec	43.5	9.2	28.9	6.3
Annual Mean:		6.8		4.5

Ninepipe - Ronan
Integrating Nephelometer
B-Scat 10^{-5} m^{-1}

	1981		1982	
Month	Hourly Max.	Monthly Mean	Hourly Max.	Monthly Mean
Jan.			26.6	3.7
Feb.			59.1	4.4
Mar			14.2	2.1
Apr			19.2	2.1
May			57.6	2.8
Jun			14.7	5.6
Jul	12.4	3.0	13.7	2.1
Aug	26.8	4.7	49.0	2.4
Sep			13.4	2.1
Oct	43.7	5.2	13.5	3.0
Nov	12.6	2.1	21.1	4.3
Dec	29.1	3.8	21.1	4.4
Annual Mean:		3.8		3.3

I. CENTRAL MONTANA

I. CENTRAL MONTANA

Central Montana air monitoring sites have been grouped together to include those sites in Bozeman, Havre and Lewistown. Table I-I lists the central Montana sites; Figure 1-I shows the site locations.

Bozeman's population increased nearly 16 percent from 1970 to 1980 (18,670 to 21,611) while Gallatin County increased 32 percent in the same time period (32,505 to 42,821). Havre and Lewistown had only moderate increases. Havre's population increased from 10,558 to 10,842 in the decade, while Lewistown's went from 6,437 to 7,709.

The three cities are all centers of agricultural activity for their areas. Bozeman is the home of Montana State University with an enrollment of about 10,000 students. There are no major industries in any of the cities.

The elevations of the cities are as follows: Bozeman, 4800 feet; Lewistown, 4000 feet; Havre, 2500 feet. Bozeman and Lewistown have similar climates: weather and wind patterns (usually calm) are dictated by local mountainous terrain; each receives about 20 inches of precipitation a year. Havre's climate tends to be more harsh; the winters tend to be cold and windy and the summers hot and dry. Havre receives about 12 inches of precipitation annually. All cities are east of the Continental Divide and experience chinook winds.

Table I-I

Central Montana Area Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Bozeman					
*Traphagen	Gallatin	State AQB	Population oriented	Center city - residential	Traphagen Hall, MSU
E. Main	Gallatin	State AQB	Population oriented	Center city- commercial	34 No. Rouse Street
Whittier School	Gallatin	State AQB	Population oriented	Center city - residential	Whittier School Peach & 5th Street
Havre					
City Bldg.	Hill	State AQB	Population oriented	Center city- residential	520 4th Street
Lewistown					
Downtown	Fergus	State AQB	Population oriented	Center city- commercial	Roof of Midstate Bank 450 W. Janeaux

*Site discontinued in 1982

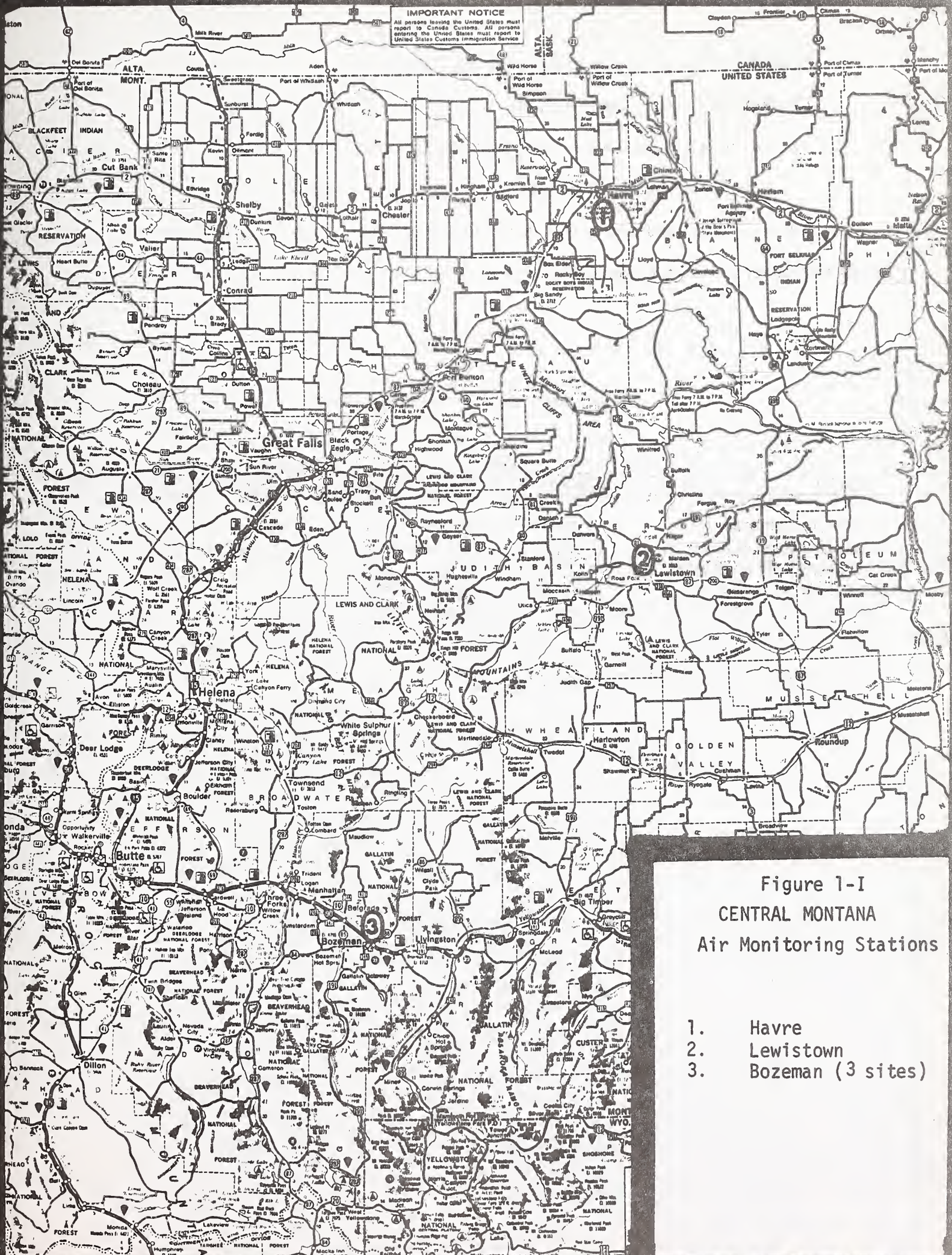


Figure 1-I
CENTRAL MONTANA
Air Monitoring Stations

1. Havre
2. Lewistown
3. Bozeman (3 sites)

Pollution sources for all three cities include:

1) Agricultural (particulate)

2) Paved and unpaved roads (particulate)

3) Home heating devices (fine particulate, CO, HC)

Table I-II summarizes TSP data for central Montana. The only site of any major concern is the Bozeman-East Main site.

Table I-II

Central Montana Area - TSP
Micrograms Per Cubic Meter

Site	1981			1982		
	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Havre-Central Bldg.	59	162	145	49	183	160
Lewistown - Downtown	*62	130	116	40	125	96
Bozeman-Traphagen***	25	69	60	25	59	56
Bozeman-E. Main	68	246	194	56	265	148
Bozeman-Whittier School**	*56	89	74	47	143	125

*Less than 8 months data
**Less than 8 months of data
***Shut down 1982

J. POPLAR RIVER

J. POPLAR RIVER

The Poplar River Study in Daniels County began in March, 1977 to gather background data prior to the start-up of a two unit coal-fired power plant at Coronach, Saskatchewan. The first 300 megawatt unit was originally scheduled to go on line in December 1979. Due to construction delays, the plant did not start up until October, 1980. The second unit was scheduled to go on line in November of 1982, but due to delays is scheduled for July 1983.

The Poplar River project was funded by the Federal Government until June, 1981; funding has now been picked up by the State with the project being continued until June 1983. The Poplar River project was extended by the 1983 Montana Legislature for an additional year, commencing after the Coronach plant is in full commercial operation.

Air quality in the Scobey-Poplar River area is fairly representative of the entire northeast corner of the state. The area is part of the Northern Great Plains with an elevation of 2000-2500 feet. It tends to have cold, hard winters with persistent high winds. Precipitation for the area averages 12-14 inches per year.

Population for the northeast corner of the state tends to be sparse. Population counts for Daniels, Roosevelt, and Sheridan counties totaled 18,663 in 1980.

Pollution sources for the Scobey area include:

1) Agriculture (particulates)

2) Canadian coal-fired power plant (particulates, SO_2, NOx)

Table J-I provides the monitoring site descriptions for this area and Figure 1-J shows the locations.

TSP (Table J-II) levels are well below national standards. However, occasional high levels occur due to wind-blown dust from summer-fallowing and other agricultural practices. The levels encountered at the Scobey sites compare favorably with other background sites throughout eastern Montana.

Table J-I

Poplar River Area Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Scobey Border Site	Daniels	State AQB	Background surveillance	Rural - agricultural	80 yards west of the US Customs Office
Richardson	Daniels	State AQB	Background surveillance	Rural-near urban	1 mi N of Scobey near Hwy 13
Hanrahan	Daniels	State AQB	Background surveillance	Rural - agricultural	SE Corner, Sec. 3, T36N, R49E

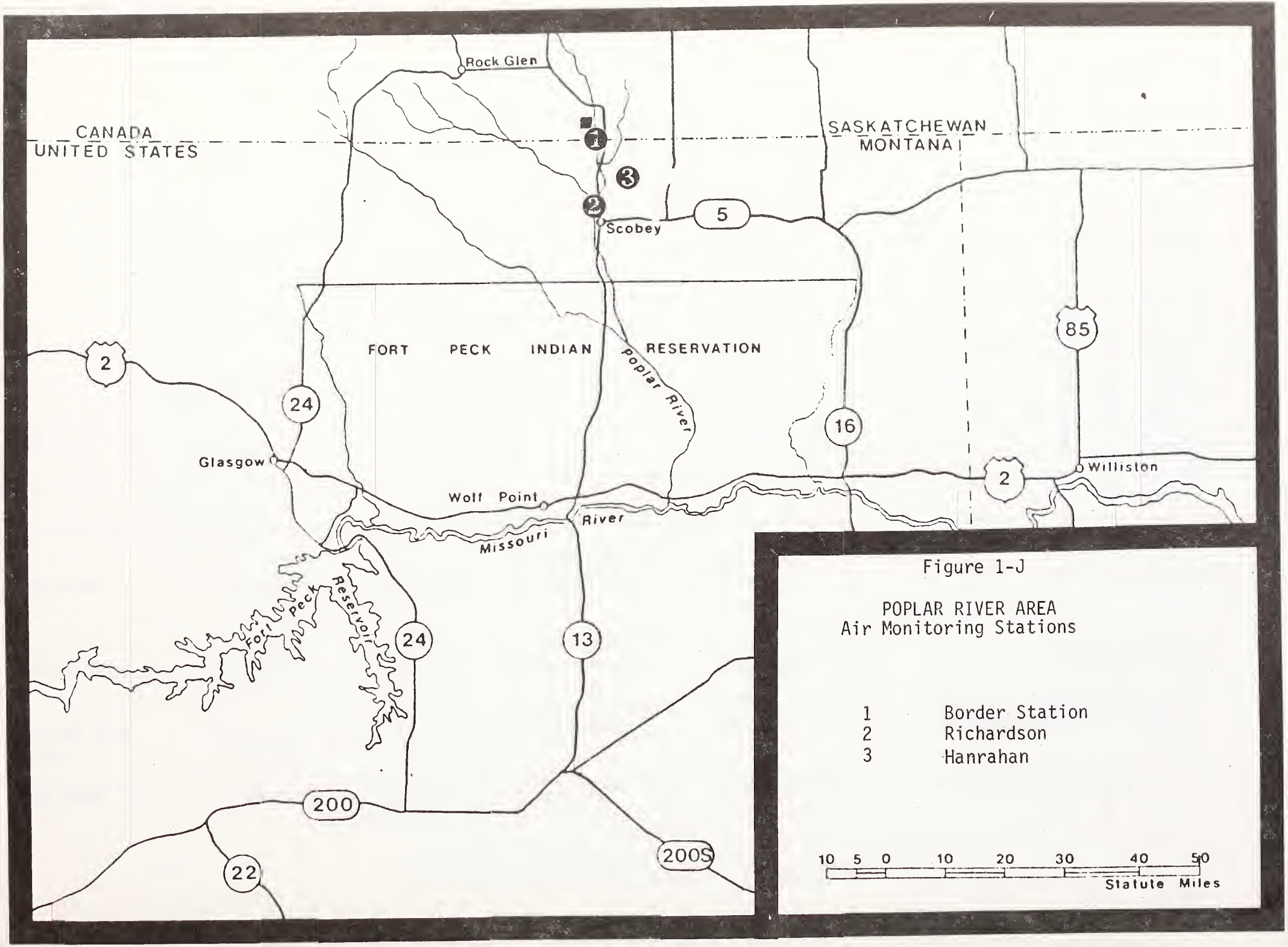

Rock Glen
CANADA
UNITED STATES
SASKATCHEWAN
MONTANA
1
2
3
Scobey
5
FORT PECK INDIAN RESERVATION
Poplar River
85
2
24
16
Glasgow
Wolf Point
Williston
2
Missouri River
Fort Peck Reservoir
24
13
200
200S
22
Figure 1-J
POPLAR RIVER AREA
Air Monitoring Stations
1 Border Station
2 Richardson
3 Hanrahan
10 5 0 10 20 30 40 50
Statute Miles

Table J-II
Poplar River Area - TSP
Micrograms Per Cubic Meter

Site	1981 Geo. Mean	1981 1-High	1981 2-High	1982 Geo. Mean	1982 1-High	1982 2-High
Scobey - Border	28	1358	637	17	234	50
Scobey - Richardson	*34	452	82	*13	63	28
Scobey - Hanrahan	23	544	294	16	144	47

*Less than eight months of data

Table J-III summarizes the visibility in the Scobey area. Generally, the visibility is very good, with only a few days where the visibility was less than ten miles (26 x 10^{-5} m^{-1} B-scat). Usually the visibility was on the order of 50 miles or better (3 x 10^{-5} m^{-1} B-scat or less).

Table J-III
Scobey Border Site
Integrating Nephelometer
B-Scat 10^{-5} m^{-1}

Month	1981 Hourly Max.	1981 Monthly Mean	1982 Hourly Max.	1982 Monthly Mean
Jan	15.7	2.1	7.5	1.7
Feb	19.1	2.8	7.9	1.9
Mar	8.9	1.7	26.0	2.4
Apr	18.4	1.6	4.7	1.2
May	31.7	3.7	9.0	1.0
Jun			27.8	3.4
Jul			31.3	5.1
Aug	91.5	11.4	17.4	1.8
Sep	60.6	6.6	8.6	1.7
Oct	9.6	2.7	4.1	1.3
Nov	8.3	2.2	5.0	1.6
Dec			11.5	1.4
Annual Mean:		3.9		2.0

Sulfate and nitrate analyses were performed on hi-vol filters using automated colorimetric methods. Values for these parameters are very low and consistent with what would be expected for background sites. Table J-IV summarizes this data for the three hi-vol sites.

Table J-IV
Poplar River Area - Sulfates and Nitrates
Micrograms Per Cubic Meter

		1981			1982		
Site		Mean	1-High	2-High	Mean	1-High	2-High
Scobey-Border	NO_3	.8(12)	3.5	2.9	.7(11)	1.8	1.5
	SO_4	3.4(12)	20.4	18.4	3.0(11)	7.4	6.3
Scobey - Richardson	NO_3	1.1(6)	4.2	1.7	.7(5)	1.5	1.1
	SO_4	4.2(6)	9.3	6.0	2.7(4)	5.1	4.6
Scobey - Hanrahan	NO_3	1.0(12)	3.9	3.0	.7(11)	2.6	1.8
	SO_4	3.0(12)	15.2	7.6	2.8(11)	9.1	7.2

( ) - parentheses denotes number of sample months.

Table J-V lists a summary of that data. Sulfur dioxide levels are practically non-existent, although a slight increase was evident after the first unit started up. An hourly maximum of .060 ppm was recorded in September of 1982 at the Border site. An hourly maximum of .03 was recorded at Hanrahan during November 1982.

Table J-V
Poplar River Area - Sulfur Dioxide
Parts Per Million

	Scobey Border - 1981		Scobey Border - 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.007	.001	.016	.000
Feb	.029	.002	.017	.004
Mar	.004	.001	.023	.008
Apr	.004	.000	.017	.004
May	.019	.002	.022	.002
Jun	.014	.001	.028	.002
Jul	.017	.001	.023	.001
Aug	.009	.003	.033	.001
Sep	.036	.003	.060	.002
Oct	.006	.001	.047	.003
Nov	.020	.002	.036	.005
Dec	.012	.002	.022	.000
Annual Mean:		.002		.003

	Hanrahan 1981		Hanrahan 1982	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.005	.001	.005	.001
Feb	.007	.001	.009	.001
Mar	.031	.002	.007	.001
Apr	.009	.001	.003	.000
May	.003	.000	.012	.001
Jun	.051	.001	.005	.000
Jul			.000	.000
Aug	.005	.001	.010	.000
Sep			.022	.000
Oct	.015	.000	.013	.000
Nov	.010	.000	.029	.000
Dec	.007	.001	.012	.008
Annual Mean:		.001		.000

For a more comprehensive analysis of the data from this area, a copy of Background Air Quality Studies of the Poplar River Area of Northeastern Montana, 1978, can be obtained from state libraries or the Air Quality Bureau.

APPENDIX A

Glossary of Air Quality Terms

APPENDIX A

GLOSSARY OF AIR QUALITY TERMS

ABSORPTION

(Engineering) The process of dissolving a gas or one of a mixture of gases in a liquid

(Bio-medical) The taking up of fluids or other substances by the skin, mucous surfaces, or absorbent vessels

ACID MIST

A mist of fine aqueous droplets which contain dissolved acidic compounds, such as sulfuric acid.

ADIABATIC LAPSE RATE

The change of temperature with height of a parcel of dry air if it is lifted or lowered, with no loss or gain of heat.

ADSORPTION

The adhesion in an extremely thin layer of the molecules of gases or dissolved substances, or liquids, to the surfaces of bodies with which they are in contact.

AEROSOL

Suspended particulate matter consisting of smoke, dusts, and fumes which are either solid or droplets of liquids. Aerosol particles vary in size from well below one micron to approximately 100 microns in diameter.

AMBIENT AIR

That portion of the atmosphere, external to buildings, to which the general public has access.

AMBIENT AIR QUALITY

A physical and chemical measure of the concentration of various chemicals in the ambient atmosphere. The quality is usually determined over a specific time period.

ANTHRACITE

A type of a coal, hard, with high luster, which contains little volatile matter distinguishing it from bituminous coal.

AROMATIC

In organic chemistry, designating a large class of organic compounds which contain benzene rings. The simplest aromatic compound is benzene.

ASTM

ASTM (American Society for Testing Materials) is a voluntary organization of companies and individuals, established for the purpose of setting up standard methods of testing, so that different individuals can obtain comparable test results upon the same sample. ASTM standard test methods are available for almost all types of materials, including some air pollutants. An ASTM Apparatus is the specific apparatus designated by ASTM for a specific test.

ATMOSPHERIC PRESSURE (Also called barometric pressure)

The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question. As with any gas, the pressure exerted by the atmosphere is ultimately explainable in terms of bombardment by gas molecules; it is independent of the orientation of the surface on which it acts.

Atmospheric pressure is one of the basic meteorological elements. It is measured by many varieties of barometer, and is expressed in several units systems. The most common unit used is the millibar (one millibar equals 1000 dynes per cm^2). Unique to the science of meteorology is the use of inches (or millimeters) of mercury; that is, the height of a column of mercury that exactly balances the weight of the column of atmosphere whose base coincides with that of the mercury column. Also employed are units of weight per area and units of force per area. A standard atmosphere has been defined in terms of equivalence to each of the above unit systems, and it is used as a unit itself.

ATTAINMENT AREA

A geographic area in which the quality of the air is better than federal air pollution standards. PSD requirements apply to attainment areas.

ATOMIZING SCRUBBER

A wet collector in which use is made of a liquid medium to increase the size of aerosol particles to facilitate its removal from a gas stream. In an atomizing scrubber, water is introduced at the throat of a venturi through which gas (containing aerosol particles) is moving at high velocity. Units of this type have a high pressure drop, and are used to get high removal efficiencies for particles of relatively small diameters (e.g., below 1.5 microns).

BACT - "Best Available Control Technology"

The term best available control technology means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant. (Clean Air Act, Section 169(3))

BAGHOUSE

An enclosure containing many cloth bag filters. Dust laden air entering at the top or bottom of a bag is discharged through the cloth directly to the atmosphere while the solid particles are deposited inside the bag.

BITUMINOUS

A type of coal, soft, which yields considerable volatile matter when heated. Burning this type of coal in open fireplaces or household stoves has caused serious air pollution problems (London, formerly in Pittsburgh and Saint Louis) because of the lack of sufficient temperature above the firebed to burn the volatilized gases and tars (i.e. both gaseous and particulate emissions).

BRONCHITIS

Inflammation of the bronchial tubes (wind pipe), which includes the bronchi (s. bronchus) and the choncia (s. bronchium) and through which air passes to the lungs.

BULK DENSITY

The quotient of the total mass of a mixture (usually liquid plus solid or gas plus solid) divided by the total volume.

CARBON DIOXIDE (CO_2)

A colorless, odorless, incombustible gas, used to make carbonated beverages, dry ice, etc. It is a product of respiration, combustion, fermentation, decomposition and other natural processes, and is always present in the atmosphere.

CASCADE IMPACTOR

A device for separating dust particles from a moving air stream. In principle a dust particle collides or impacts on a solid surface and thus is collected while the air stream moves around the solid surface. An assembly of a series of such surfaces is called a cascade impactor.

CHROMATOGRAPHY

A technique used by chemists to cause the separation of small amounts of chemical compounds in order to determine their identity and quantity.

CIRCULATION PATTERN

The general geometric configuration of atmospheric circulation at a given time and region.

CLASS I AREA

Any area which is designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each national park over 6,000 acres and each national wilderness area over 5,000 acres.

CLASS II AREA

Any area cleaner than federal air quality standards which is designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area.

CLASS III AREA

Any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in a Class III area.

CLEAN AIR ACT

A law enacted by Congress to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population.

CRITERIA POLLUTANT

A pollutant for which EPA has established a national ambient air quality standard under Section 109 of the Clean Air Act. Present criteria pollutants are: carbon monoxide, hydrocarbons, lead, nitrogen dioxide, ozone, sulfur dioxide and total suspended particulate.

CLOTH FILTER
A cloth bag filter; see BAGHOUSE

COLLECTION EFFICIENCY
The ratio of the weight fraction of aerosol which is retained in the collector to that which entered the collector. Collection efficiency could be specified in terms of particle numbers or other physical characteristics for special cases.

COMBUSTION
The rapid reaction of carbon containing substances (or other oxygen demanding materials) with oxygen producing a rapid temperature increase and a flame.

COMBUSTION CHAMBER
That part of a furnace or incinerator in which burning takes place.

CONING
A name which describes the approximate shape of a smoke plume in a neutral atmosphere (see FANNING).

CONVECTION
(In meteorology) a mechanical process thermally produced involving the upward and downward transfer of a limited portion of the atmosphere.

CYCLONE COLLECTOR
A device for separating solid particles from gases or liquids. The carrier gas or liquid is made to move in a rapid spiralling motion (cyclonic) throwing the solids by centrifugal force to the walls of the collector.

DEPOSITION VELOCITY
The minimum velocity of a small particle suspended in a moving air stream that will give the particle sufficient momentum to carry it into a target (deposit the particle on a collecting surface). At lower velocities the particle will remain in the air stream and go around the target.

DEW POINT (or dew point temperature)
The temperature to which a given parcel of air must be cooled at constant pressure and constant water vapor content in order for saturation to occur.

DISPERSION
The action of mixing air containing a high concentration of pollutants arising from a pollutant source with the ambient air thereby reducing the ambient pollutant concentration.

DUST COLLECTORS
Any device used to remove particulate matter from exhaust streams

DUSTFALL
The amount of large particulate matter deposited per unit time per unit area of surface.

ELECTROLYTIC BATH
A container of liquid or molten materials through which an electric current is passed to cause chemical decomposition.

ELECTROSTATIC PRECIPITATOR
A device for collecting dispersed particles. Particle laden air is passed between two surfaces carrying a high electric potential and under the force of the electric field the particles are driven to a collecting electrode and precipitated.

EMPHYSEMA
The presence of air in the alveolar tissue of the lungs due to rupture of the alveoli. Progressive development of this condition leads to enlargement of the lungs and the chest cavity simultaneously with reduced capacity for breathing and efficiency of breathing.

FANNING
The characteristic appearance of a smoke plume emitted under extreme inversion conditions, where little vertical mixing of smoke in the atmosphere takes place (see CONING).

FLUE GASES
All the gases discharged from any stationary combustion process

FLUE GAS DESULFURIZATION
One of several processes by which sulfur dioxide is removed from the flue gas as a disposal solid, elemental sulfur or sulfuric acid.

FLUORIDE
The generic name of all simple chemical compounds containing fluorine, as sodium fluoride.

FLUORINE
A nonmetallic chemical element, a pale yellow, highly corrosive and toxic gas.

FLUOROSIS
Chronic poisoning by fluorides

FLY ASH
The non-combustible particles contained in flue gas.

FOSSIL FUELS
Oil, coal or natural gas

FREE LIFT
The actual lifting force of an inflated balloon, usually expressed in grams. The free lift plus the weight of the balloon and attached equipment is the total lift.

FUME
A fume is formed by sublimation of solid particles from the gaseous state. The term is frequently used to describe suspensions of very small (submicron) particles.

GASIFICATION
The process of converting solid or liquid fossil fuels to gaeous fuel, usually with the elimination of sulfur.

GRAVITY SETTLING

The application of gravitational force to cause solid particles to drop out of the air. Practically it is useful for removing only particles larger than 50 microns in size.

HALOGEN

Any of the five very active, nonmetallic chemical elements: fluorine, chlorine, bromine, iodine, and astatine.

HYDROCARBON

Any of the class of compounds consisting solely of hydrogen and carbon.

1. paraffins whose molecules contain the maximum possible of hydrogen.
2. aromatics, whose molecules contain benzene rings.
3. naphthenes, whose molecules are ring shaped.
4. olefins, whose molecules contain double bonds.

HYDROFLUORIC ACID

A water solution of hydrogen fluoride. In the gaseous state, hydrogen fluoride is colorless, corrosive, and poisonous.

HYDROGEN

The most simple chemical element and the lightest of all gases. It is found chiefly combined with oxygen to form water; also found in acids, bases, hydrocarbons, etc.

INCINCERATORS

Any device to burn solid and combustible liquid residues or wastes in order to reduce their bulk. The ash residue may be used for landfill or dumped at sea. Flue fed incinerators are those where the garbage or refuse is supplied to the combustion chamber through the same flue used for discharge of the products of combustion. A power generating or combination incinerator is one in which the heat from refuse combustion is used to generate steam. Primary air is usually supplied with the material being burned. Secondary air is usually supplied to complete combustion of incompletely burned gaseous fractions over the fuel bed. Tertiary air may be supplied to further improve combustion in a secondary chamber.

INCREMENTS

The amount of additional pollution, beyond already existing background levels, which may be allowed in a particular PSD area. The size of allowable increment varies with whether the area is Class I, Class II or Class III.

INVERSION

A meteorological condition in which the temperature of the atmosphere rises with increased elevation instead of falling; a negative temperature lapse rate.

INVERSION LAYER

A layer in the atmosphere through which the temperature remains constant or increases with altitude.

ICAP - Inductive Coupled Argon Plasma

Measurement of emission spectra which is excited by radiofrequency in a plasma. The emissions from analytes will produce signals on photomultiplier tube.

ISOKINETIC
Having the same speed and direction. When sampling gas streams for certain purposes it is important that the gas flow into the sampler be of the same speed and direction as the main gas stream. This is called isokinetic sampling.

LAER - Lowest Achievable Emission Rate
A requirement applying to proposed new or modified major stationary sources in nonattainment areas. LAER means the "rate of emissions which reflects
a. The most stringent emission limitation which is contained in the (SIP) of any state for such class or category of source.... or
b. the most stringent emission limitation which is achieved in practice..., whichever is more stringent.

LAPSE RATE
The change in an atmospheric variable, usually temperature, with height.

LIGNITE
A naturally occurring coal-like material often having a distinct woody texture.

MACROMETEOROLOGY
Large-scale weather events as opposed to local micrometeorological events.

MERCAPTAN
One of a class of sulfur-containing organic chemical compounds (R-SH), which have an extremely offensive odor.

METEOROLOGY
The science dealing with the atmosphere and its phenomena, particularly relating to weather.

METHANE
The first of the series of hydrocarbons (CH). It is a colorless, odorless, flammable gas and is the chief constituent of natural gas.

MICROMETEOROLOGY
The science of small-scale weather events.

MICRON (MU)
A metric unit of measure of length equal to one millionth of a meter and to one thousandth of a millimeter. This unit is often used for describing sizes of airborne particles and is commonly designated by the Greek letter u (mu).

MIXING HEIGHT (or mixing depth)
The thickness of the atmospheric layer, measured from the surface upward, through which pollutants are presumed to mix by virtue of convection caused by daytime heating at the surface. The designation of mixing height implies the existence of an inversion, in which case the mixing height is also the height of the inversion base.

NECROSIS
Gradual decay in trees or plants

NITROGEN OXIDES

Compounds of nitrogen including N_2O, NO, NO_2, NO_3, N_2O_3, N_2O_4, N_2O_5. Those most commonly encountered in the atmosphere are nitrous oxide (N_2O), a normal constituent of the air, and nitric oxide (NO) and nitrogen dioxide (NO_2) which are classified as pollutants.

NONATTAINMENT AREA

A geographic area in which the quality of the air is worse than federal air pollution standards. PSD requirements do not apply in nonattainment areas.

NSPS - New Source Performance Standards

EPA emission standards for certain categories of new or modifed air pollutant sources.

OXIDANT

Any chemical element or compound which will cause any other element to increase in positive valence in a chemical reaction. Less precisely, any chemical element or compound, e.g. NO_2, including oxygen which has the same effect as oxygen in a chemical reaction. In photochemical smog, the sum of all compounds detected by reaction with reducing agent, e.g., potassium iodide solution.

OZONE

A form of oxygen, O_3, having three atoms of oxygen to the molecule. It is found in the atmosphere in minute quantities and is a powerful oxidizing agent. It is a toxic constituent of photochemical smog.

PARAFFINS

A class of saturated hydrocarbons characterized by their chain-like molecular structure. See HYDROCARBON.

PARTICLES

Any solid matter emitted by a pollutant source. It is composed of settleable matter (which will settle as dust within a reasonable period of time) and suspended matter (which remains suspended in the atmosphere until washed out by precipitation, deposited by impaction, or some other process).

PARTICULATE MATTER

Finely divided solids or liquids. See AEROSOL.

PHOTOCHEMICAL SMOG

Air pollution resulting from light-induced reaction between certain organic materials and nitrogen dioxide.

PILOT BALLOON

A small balloon whose ascent is followed by a theodolite in order to obtain data for the computation of the speed and direction of winds in the upper air.

PILOT-BALLOON OBSERVATION (Commonly pibal)

An observation method for winds aloft; that is, the determination of wind speeds and directions in the atmosphere above a station. This is done by reading the elevation and azimuth angles of a theodolite while visually tracking a pilot balloon.

The ascension rate of the balloon is approximately determined by careful inflation to a given total lift. After release from the ground, periodic readings (usually at one-minute intervals) of elevation and azimuth angles of the balloon are recorded. These data are transferred to a winds-aloft plotting board, and the wind speed and direction at selected levels are calculated by trigonometric methods.

PREVAILING WIND DIRECTION (or prevailing wind)

The wind direction most frequently observed during a given period. The periods most frequently used are the observational day, month, season and year.

PSD - Prevention of Significant Deterioration

A planning and management process under Sections 160 through 169 of the CAA for allocation and use of air resources.

RADIATION INVERSION

A type of atmospheric inversion occurring usually at night when the earth's surface loses heat by radiation, thus cooling the layer of air next to the ground. See INVERSION.

RESIDUAL FUEL OIL

The remainder after the more valuable petroleum gas, gasoline, lubricants, paraffin waxes and asphalt are removed from petroleum. This heavy oil is used as fuel and is graded number 4, 5, or 6, with the heavier grades bearing higher numbers. These grades are also cheaper and usually contain more sulfur. The amount of sulfur in the "RESID" depends on the feed stock (source of the crude oil) and the use of dehydrosulfurization processes.

RINGLEMANN CHART

A chart showing four numbered shades of gray as well as pure white and all black, used by visual comparison for estimating the density of smoke as it emerges from a stack. The matched comparison with the chart is referred to as a Ringlemann Number.

SCATTERING COEFFICIENT

Amount of back scatter of light due to suspended particulate matter in the air and relates the measurement to visibility and the level of particulates.

SCRUBBER

Any device in which an aerosol is removed from a gas stream by a liquid droplet.

SETTLING VELOCITY

The speed at which an object will move through its surroundings under the force of gravity.

SIP - State Implementation Plan
A state developed, federally approved plan for implementing and enforcing requirements of the CAA.

SMOG
A combination of smoke and fog, usually generated as a result of atmospheric contamination. London (England) type smog arises as a result of the combined presence of sulfur oxides and particulates in a humid environment. Los Angeles smog or photochemical smog occurs when sunlight generated reactions involving hydrocarbon, ozone and nitrogen oxide take place. The smog is most visible when high concentrations of water vapor occur in the atmosphere simultaneously but may appear as a bluish haze in a dry atmosphere.

SOLAR RADIATION
The total electromagnetic radiation emitted by the sun.

SOOT
Aggregated particles of unburned carbon produced by incomplete combustion. The soot may contain sufficient amounts of sulfur oxides or compounds to damage paint or enamel finishes.

SPRAY CHAMBER
The simplest type of gas scrubber. Gas is passed countercurrent to falling drops of liquid (usually water) from a bank of spray nozzles. A typical appliction is the removal of fly ash and cinders from flue gases.

STABLE
Pertaining to the atmosphere or an atmospheric layer in the condition of static stability, that is, an atmosphere whose temperature lapse rate and moisture distribution is such as to suppress vertical exchange of air.

STAGNATION
With respect to air pollution, the persistence of a given volume of stable air over a region, permitting an abnormal buildup of pollutants from sources within the region.

STATIC STABILITY (Also called hydrostatic stability, vertical stability, convective or convectional stability)
The state of the atmosphere when it is stable relative to vertical displacements. Such an atmosphere tends to remain stratified, in that any air that is displaced vertically is subjected to a buoyant force that tends to restore it to its original level.

Static stability is determined primarily by the temperature lapse rate; an inversion layer is an extreme example of a statically stable layer.

STOICHIOMETRIC
In the exact combining proportions of materials involved in a specific chemical reaction.

SUBSIDENCE INVERSION
An atmospheric inversion due to the downward motion or air, about a stationary high-pressure area with concomitant adiabatic temperature rise. Such an inversion is common to Southern California in the warm months of the year. See INVERSION.

SURFACE INVERSION (or ground inversion)

A temperature inversion based at the earth's surface; that is, an increase of temperature with height beginning at the ground level.

This condition is due primarily to greater loss of heat due to radiation at and near the surface than at levels above. Thus, surface inversions are common over land prior to sunrise and in winter over high-latitude continental interiors.

SYNERGISM

Cooperative action of discrete pollutants such that the total effect is greater than the sum of the two effects taken independently.

TEMPERATURE INVERSION

A layer in which temperature increases with altitude. The principal characteristic of an inversion layer is its marked static stability, so that very little turbulent exchange can occur within it. Strong wind shears often occur across inversion layers, and abrupt changes in concentrations of atmospheric particulates and atmospheric water vapor may be encountered on ascending through the inversion.

When, in meteorological literature and discussion an "inversion" is mentioned, a temperature inversion is usually meant.

THEODOLITE

An optical instrument which consists of a sighting telescope mounted so that it is free to rotate around horizontal and vertical axis and graduated scales so that the angles or rotation may be measured. The telescope is usually fitted with a right-angle prism so that the observer continues to look horizontally into the eyepiece, whatever the variation of the elevation angle. In meteorology, the theodolite is used principally to observe the motion of a pilot balloon.

TOTAL LIFT

The upward force produced by the gas in a balloon. It is equal to the sum of the free lift, the weight of the balloon, and the weight of auxiliary equipment carried by the balloon.

WET COLLECTORS

Dust collectors which operate by contacting the dust with a liquid (usually water). The class includes spray chambers and atomizing scrubbers.

WIND

Air in motion relative to the surface of the earth. Since vertical components of atmospheric motion are relatively small, especially near the surface of the earth, meteorologists use the term to denote almost exclusively the horizontal component. Vertical winds are always identified as such.

WIND ROSE

A diagram showing the wind direction and speed and their variations for a day, a month, or any other specified period of time, for a specific location and altitude.

WIND VANE

An instrument used to indicate wind direction.

APPENDIX B

Ambient Air Quality Standards

APPENDIX B

AMBIENT AIR QUALITY STANDARDS

In December, 1977, the Montana Board of Health and Environmental Sciences directed the Air Quality Bureau to propose an administrative rule containing new enforceable ambient air quality standards.

A set of standards had been on the books for ten years; however, they were considered as goals or guidelines rather than enforceable standards.

It was decided that before new standards were adopted there should be a thorough review to determine whether the old standards were still appropriate or whether scientific research completed since their adoption indicated different standards were necessary.

Subsequently, $147,000 was provided to hire a staff and consultants. This study was called the Montana Ambient Air Quality Standards Study (MAAQS).

As a result of this work a draft environmental impact statement was published in January, 1979; a final statement in February, 1980.

After several public meetings and experts' testimony, the Board of Health and Environmental Sciences passed a set of "enforceable" standards in August, 1980. Table AP-B-I lists the Montana and national ambient air quality standards. Additional information about the standards is provided on the following page.

Table AP-B-I

MONTANA AND NATIONAL AIR QUALITY STANDARDS

POLLUTANT	MONTANA STANDARD	FEDERAL PRIMARY STANDARD	FEDERAL SECONDARY STANDARD
Total Suspended Particulates	75 ug/m^3 annual average 200 ug/m^3 24-hr average*	75 ug/m^3 annual geometric mean 260 ug/m^3 24-hr average*	60 ug/m^3 annual geometric me 150 ug/m^3 24-hr average*
Sulfur Dioxide	0.02 ppm annual average 0.10 ppm 24-hr average* 0.50 ppm 1-hr average**	0.03 ppm annual average 0.14 ppm 24-hr average*	0.5 ppm 3-24 average*
Carbon Monoxide	9 ppm 8-hr average* 23 ppm hourly average*	9 ppm 8-hr average* 35 ppm 1-hr average*	9 ppm 8-hr average*
Nitrogen Dioxide	0.05 ppm annual average	0.05 ppm annual average	0.05 ppm annual average
Photochemical Oxidants (ozone)	0.10 hourly average*	0.12 ppm 1-hour average*	0.12 ppm 1-hr average*
Lead	1.5 ug/m^3 90-day average	1.5 ug/m^3 calendar quarter average	None
Foliar Fluoride	35 ug/g grazing season average 50 ug/g monthly average	None	None
Hydrogen Sulfide	0.05 ppm hourly average*	None	None
Settled Particulate (Dustfall)	10 gm/m^2 30-day average	None	None
Visibility	Particle scattering coefficient of 3 x 10^{-5} per meter annual average***	None	None

*Not to be exceeded more than once per year
ug/m^3 micrograms pollutant per cubic meter of sampled air
ppm parts pollutant per million parts of sampled air
**Not to be exceeded more than 18 times per year
***Applies to PSD Class I areas

Air quality standards have been developed at the National level for six classes of air pollutants and at the State level for nine pollutants plus visibility. Below is a synopsis of each of the pollutants.

Sulfur Dioxide - Sulfur dioxide originates from the burning of fossil fuels such as coal or oil. The pollutant is known for causing significant loss in crop yield, rusting metals, reducing visibility and irritation of eyes, nose, throat and lungs.

Particulate Matter - Particulate matter may originate from natural sources such as forest fires and erosion, or result from automobiles, industrial processes, unpaved roads, agriculture, construction and other human activities. These tiny particles can damage paint, reduce visibility, and carry poisonous chemicals into the lungs causing cellular damage.

Carbon Monoxide - Carbon monoxide is a by-product of the incomplete combustion of organic fuels. The most notorious source is the automobile. This odorless gas can, in small amounts, cause headaches, dizziness, fatigue and slow reactions. It can be especially dangerous for people with heart disease. In larger amounts it can cause death.

Photochemical Oxidants (Ozone) - Photochemical oxidants are produced in the atmosphere when hydrocarbons and nitrogen oxides, combustion wastes from gasoline and other fuels, are exposed to sunlight. Oxidants irritate the eyes, nose, and throat, make breathing difficult, reduce visibility, and damage vegetation.

Hydrocarbons - Hydrocarbons are the unburned chemicals from the combustion or evaporation of organic compounds. Automobile exhaust and uncontained storage of petroleum products are common sources of hydrocarbons. They have been known to cause vegetative damage and contribute to photochemical oxidants.

Nitrogen Oxides - Nitrogen oxides usually originate in high-temperature combustion processes including diesel engines. It is not only a component of photochemical oxidants, but causes an unpleasant smelling brown haze, and is irritating to the nose and throat.

Fluoride - Sources of fluorides include the aluminum, glass, brick, fertilizer and, to a smaller degree, the oil industries. In excessive amounts, fluorides can cause bone deformities and damage vegetation.

Lead - Lead in the air is generally the result of automobiles and ore smelters. Physical problems of high lead content include gastrointestinal cramps, central nervous system effects, kidney disease and anemia.

Hydrogen Sulfide - Sources of hydrogen sulfide, the "rotten egg" pollutant include sewage treatment, kraft pulp and oil industries. The pollutant can damage paint, tarnish copper, injure vegetation, produce a losss of the sense of smell, cause severe respiratory tract irritation and in large doses, cause death.

Visibility - Visibility reductions are due to the amounts of TSP, aerosols and gases present in the atmosphere.

APPENDIX C

Attainment Nonattainment Designations

APPENDIX C

ATTAINMENT-NONATTAINMENT DESIGNATIONS

This appendix briefly summarizes the designation of attainment/non-attainment areas for Montana. For the purposes of this report, we have copied portions of a January 1978 non-attainment designation document and added changes which have occurred. The copied portions include the general narrative and pollutant attainment status. Specific maps of the area have not been included. For a more complete report, the user can request a copy from the Air Quality Bureau.

Since the original non-attainment designation document was submitted to EPA, additional ambient monitoring data precipitated three classification changes. The non-attainment status for Butte particulates was changed during 1978 from non-attainment of secondary standards to non-attainment of primary standards. In addition, a portion of Great Falls along 10th Avenue South was designated non-attainment for carbon monoxide in 1979. These three changes have been incorporated into Appendix C.

I. INTRODUCTION

The 1977 Clean Air Act Amendments, enacted by Congress August 7, 1977, contained many new and expanded requirements regarding the control of air pollution. This report attempts to explain just one requirement contained in the amendments, but a very significant requirement. It is significant not so much in itself, but more in subsequent actions that follow. Section 107(d)(1) of the 1977 amendments requires the states to submit to EPA "...a list, together with a summary of the available information, identifying those air quality control regions, or portions thereof..." classifying these areas according to whether they meet the national ambient air quality standards (NAAQS).

II. CLASSIFICATIONS AND DATA

Standards and Classification Requirements

Five classifications are possible - three for particulate matter (PM) and sulfur dioxide (SO_2) and two for pollutants other than particulate matter or sulfur dioxide. The five classifications are summarized below.

A) Do not meet a national primary ambient air quality standard for oxidants, carbon monoxide (CO) or nitrogen dioxide (NO_2).

B) Do not meet, or in the judgment of the State will not attain or maintain in the time required by the applicable SIP, any national primary ambient air quality standard for sulfur dioxide or particulate matter.

C) Do not meet a national secondary ambient air quality standard.

D) Cannot be classified as (B) or (C), on the basis of available information, for PM or SO_2.

E) Have ambient air quality levels better than any national primary or secondary ambient air quality standard for oxidants, CO, or NO_2, or for which there is insufficient data to be classified (A) or (C).

Areas designated as A, B or C are referred to as non-attainment areas, and areas designated as D or E are referred to as attainment (or unclassified) areas.

Table 1 shows the NAAQS against which air quality data is evaluated to determine the status of areas for the classifications.

These standards apply to ambient air, or the outdoor air to which the public has access. The standard for hydrocarbons, while still legally a standard, is not being used. The primary standards are those levels which the EPA Administrator judges necessary to protect the public health with an adequate margin of safety. The secondary standards are designed to protect the public welfare from any known or anticipated adverse effects from a pollutant, in the Administrator's judgment.

Table 1

National Ambient Air Quality Standards

Pollutant	Primary Standard	Secondary
Total Suspended Particulate Matter	75 ug/m^3, annual geometric mean 260 ug/m^3, 24-hour average*	60 ug/m^3, annual geometric mean 150 ug/m^3, 24-hour average*
Sulfur Dioxide	80 ug/m^3 (0.03 ppm) annual arithmetic mean 365 ug/m^3 (0.14 ppm) 24-hour average*	1300 ug/m^3 (0.5 ppm) 3-hour average*
Carbon Monoxide	9 ppm, 3-hour average* 35 pm, 1-hour average*	Same
Nitrogen Dioxide	0.05 ppm, annual average	Same
Non-Methane Hydrocarbons	0.24 ppm, 6-9 a.m. average*	Same
Photochemical Oxidants	0.10 ppm, 1-hour average*	Same

*Not to be exceeded more than once per year

Air Quality Data

The AQB has used, whenever possible, the last four consecutive quarters of air quality data to propose the designations. The 1977 CAAA require the classifications to be made as of the date of enactment which is August 7, 1977. A certain amount of judgement is required throughout this process. Choosing to use data through September 1977 allows the designations to be made on the basis of the most current data available. Other choices were possible, such as the most recent four quarters ending and including June, 1977 or calendar year 1976, or data collected through July 1977. The choice of September 1977 provides very current data and required no consideration of emission reductions that older data might not reflect. The choice also provides a better quality of data than something older, as the data collecting techniques and quality assurance procedures are constantly improving. Also, rainfall in 1976 was extremely low, thus increasing fugitive dust problems from unpaved roads and windblown soil over a more normal year. Appendices A and B to this report contain a summary of the data used for the designations.

The AQB employed two ozone continuous monitors to propose the classification for oxidants. The federal reference method oxidants measures ozone as it is considered representative of the total oxidant problem.

Data from two continuous NOx monitors were used for the NO_2 proposals. A third monitor has not generated sufficient data from which to propose a classification for the area.

Enough carbon monoxide data have been collected in three areas to propose classifications. In two other areas, insufficient data are available. CO concentrations are determined through use of continuous monitors.

Sulfur dioxide data are available from eleven continuous monitors and several SO_2 bubblers (reference method). All bubbler data in current network show attainment. These bubblers are located in eastern Montana and have been established primarily as background stations. The continuous analyzers are primarily located to monitor the effects from point sources. Data from source-owned monitors have also been used in preparing the designation proposals.

Suspended particulate data are generated from the hi-volume sampler filter, which is the reference method. The data from some 50 stations throughout the state were employed to prepare the proposals for TSP designations.

III. DESIGNATION PROPOSALS

The designation lists include a brief narrative for each of the areas proposed as non-attainment areas, and generally a statement of the values which resulted in the non-attainment classification. The following descriptions of attainment status are those submitted to EPA on January 6, 1978.

ATTAINMENT STATUS - OXIDANTS

The Department is proposing the entire state be unclassified for oxidants. The Colstrip station produced only 112 days data out of 304 days possible in 1977, and the 1976 data are of questionable validity. The Billings site has produced good data, and shows attainment. Also, the data from the two sites collected to date seem to be somewhat contradictory, thus the proposed unclassified status.

ATTAINMENT STATUS - NOx

	Designation		
Designated Area	107(d)(1)(A) Non-Attainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings, MT, Area			*
Colstrip, MT			*
Butte, MT		*	
Rest of State		*	

Summary of Documentation

The Billings site is located in a high traffic area of the Billings urban area, and reflects a "worst case" situation for traffic-related NOx. The data show no violations of the NOx standard (1976 annual average - 0.034 ppm; 1977 annual average - 0.029 ppm). Data validity is questionable but probably within 25%. Even if the data is 25% low, there would be no violation.

Data from the Colstrip site show no violations (annual average - 0.029 ppm) and the data are valid. NOx sources are coal-fired power plants and modeling shows no violations.

Data taken in Butte are inconclusive as only two months data have been collected. No data have been obtained for other areas of the state, and therefore the rest of the state is unclassified.

ATTAINMENT STATUS - CO

Designated Area	Designation 107(d)(1)(A) Non-Attainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings Downtown Area	*		
Butte Area		*	
Colstrip Area		*	
Great Falls		*	
Missoula Area	*		

The Billings area is proposed to be designated non-attainment based on violations of the CO standard at 27th and Montana site. The boundaries in Figure 1 are based on modeling done by PEDCo for the AQMA analysis and are designed to include only that area where violations are predicted to be occurring now.

The Butte, Colstrip and Great Falls areas are proposed as unclassified as the CO monitors have not generated sufficient data to make a determination of attainment/non-attainment.

The Missoula area, Figure 2, has been designated non-attainment with less than one year's data. The data, however, show 55 8-hour averages above 9 ppm, with a maximum 8-hour average of 13.87 ppm. Boundaries have been established using the major arterials including those areas of current traffic volumes which cause violations. The designated CO area is the same as the designated area for TSP primary standard non-attainment.

A lack of data for other areas of the state requires that all areas not specifically listed be unclassified.

ATTAINMENT STATUS - SO_2

Designated Area	Designation: Non Attainment 107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Laurel Area	*		
East Helena Area	*		
Billings			*
Colstrip Area			*
Rest of State			*

Sulfur dioxide data are valid and show violations at various monitoring stations. Boundaries of non-attainment areas were determined from data and modeling.

The maps attached show the extent of the non-attainment areas above.

The Billings area is proposed as unclassified. SO_2 data in downtown Billings indicate attainment in that general area, but modeling predicts violations near major industrial sources for which no sampling data are available.

The East Helena area designation is based on data showing primary standard violations (e.g. 24-hour average = 0.26 ppm) and modeling which predicts the violations to occur as far as 0.67 km from the smelter. The boundaries are shown in Figure 3.

The Laurel area designation derives from sampling showing 24-hour violations (max. 24-hour = 0.38 ppm) and modeling shows the violations to extend 2.0 km from the refinery as shown on Figure 5.

ATTAINMENT STATUS - TSP

Designated Area	Designation Non-Attainment 107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Decker			*
Hardin			*
Billings Downtown		*	
Billings Area			*(1)
Great Falls CBD		*	
Great Falls Area			*(2)
Butte Area	*		
Philipsburg			*(1)
East Helena		*	
Three Forks			*(1)(2)
Miles City			*
Ekalaka			*(2)
Fort Peck			*
Lame Deer			*
Scobey			*
Glendive			*
Colstrip	*		
Broadus			*(1)
Lindsay			*(1)
Poplar			*
Columbia Falls	*		
Kalispell			*(1)
Libby			*
Troy			*
Missoula Area	*	*	

(1) Violation of standard due to fugitive dust from non-industrial sources - unpaved roads, etc.
(2) Insufficient data from which to classify the area.

Four areas are listed as secondary standard non-attainment. Maps are attached showing the proposed area boundaries.

The Billings downtown area is marginally above the standards (second high 24-hour 151, annual mean 60.6). The TSP problem stems from vehicle activity but the TSP will be contaminated and should not be considered fugitive dust. The proposed boundary is the Billings Downtown redevelopment area, as indicated on the map (Figure 6). The area includes the area predicted by modeling to be exceeding TSP standards.

A situation similar to Billings is found in Great Falls. The annual mean is 59.8 ug/m^3, with nine readings above 150 ug/m^3 and a maximum of 869 ug/m^3. The proposed boundary is the Great Falls CBD, shown in Figure 7.

**The Butte area exceeds both secondary standards significantly with an annual mean of 72.9 ug/m^3 and a second high of 226 ug/m^3. The boundary shown in Figure 8 is established by air quality modeling and does not follow any established area.

The East Helena area (Figure 9) is a localized problem which is proposed for designation because of the nearness of an industrial slag dump and contaminated soil.

Three areas are proposed to be designated as non-attainment for primary standard. The three areas are Colstrip, Columbia Falls and Missoula, and maps are attached depicting the boundaries.

The Colstrip area designation is based on company data showing significant violations of both the annual standard (annual mean 107 ug/m^3) and 24-hour standard (high value = 428, second high value = 379). The state station in the area does not show violations but these data do not represent the mining activity as the sampler is on top of a hill several hundred feet above the mining. This site was chosen to reflect power plant emissions, rather than low-level sources. Area boundaries include the mines and surrounding areas as shown in Figure 10.

The Columbia Falls site shows an annual mean of 68.4 ug/m^3 and second high of 271 ug/m^3. While a substantial portion of the problem probably stems from fugitive dust, the presence of several industrial sources in the area necessitates the non-attainment designation. The proposed boundary is the city limits of Columbia Falls as per Figure 11.

The Missoula area is proposed for designation, based on an annual mean of 77.4 ug/m^3 and six days above the 24-hour standard. Proposed boundaries are based on modeling performed for AQMA analysis and include all areas exceeding the primary standard. The area is also proposed for designation as non-attainment for the secondary standard. The boundaries are consistent with the AQMA analysis for predicted violations and are shown on Figure 12, primary, and Figure 13, secondary.

The remainder of the sites that show violations are due to fugitive dust as defined in the EPA policy paper, or have insufficient data on which to make a decision.

**Butte area, originally proposed non-attainment of the secondary TSP standard, was designated non-attainment of the primary standard by the EPA after the last quarter of the year's data was included. The annual average was greater than 75 ug/m^3.

The 1977 CAAA require that all areas of the state be classified. As previously discussed, there are, in effect, only two classifications - attainment (which includes unclassified) and non-attainment. If an area is designated as non-attainment, the implementation plan is required to include the non-attainment provision as specified in Part D of the Act (42 USC 7501 et seq). If an area is designated as attainment, the applicable SIP is to include the Prevention of Significant Deterioration (PSD) requirements of Part C (42 USC 7470 et seq).

Non-Attainment Areas

The requirements for a non-attainment plan depend on the pollutant for which the area is designated. For TSP or SO_2, the plan requirements are primarily directed at point sources; for CO, NO_2, or oxidants, the requirements are directed at mobile sources (motor vehicles).

Prior to promulgation of a revised plan, all major emitting facilities (emissions of more than 100 tons per year) are subject to EPA's "offset" policy. This policy requires that before any new facility can locate in an area, total emissions, including the new source, be sufficiently less than total emissions allowed without the new source to constitute reasonable progress toward attaining the standard. This means that existing sources must reduce emissions in order that the new source be permitted. There are provisions for waiver of the offset requirement providing the state has a permit program which will accomplish the same result; i.e., less total emissions in the area.

After July 1, 1979, the full requirements of a non-attainment plan must be in force. These include the application of all reasonably available control measures as expeditiously as practicable, annual incremental reduction in emissions, a comprehensive accurate current emission inventory, public, local government and State legislative involvement, and a restrictive permit program as specified in Section 173 of the Act. This permit program shall provide for annual incremental reductions in emissions, that new or modified sources comply with emission limitations which are the most stringent contained in any SIP or actually achieved in practice, whichever is lower, and that all sources under the control of the owner of the new or modified source are in compliance or on a schedule for compliance with applicable emission limitations.

This non-attainment plan is to achieve the primary NAAQS by December 31, 1982. For TSP and SO_2, no extensions are possible. For CO and/or oxidants, however, it is possible for EPA to grant an extension of this date to December 31, 1987. This extension can be granted if, despite the application of all reasonably available measures, attainment for these pollutants is not possible by 1982. This demonstration must be made before the date on which the plan is to be submitted (January 1, 1979).

If such a demonstration is made, the plan must contain three additional elements. It must include a program for analysis, for proposed new major sources, of alternatives regarding location, sizes, production processes and control techniques to demonstrate that "benefits of the proposed source significantly outweigh the environmental and social costs..." The plan must include a schedule for implementation of a vehicle emission control inspection and maintenance program, and identify the measures necessary to attain the standard by December 31, 1987.

A designation of a non-attainment area for CO or oxidants brings into play some other sections of the Act, most notably Sections 174 and 175. Congress has indicated a desire that local governments be responsible for implementation planning whenever possible, as stated in Section 174(a), as follows:

"Within six months after the enactment of the Clean Air Act Amendments of 1977, ...the State and elected officials of affected local governments shall jointly determine which elements of a revised implementation plan will be planned for and implemented or enforced by the State and which such elements will be planned for and implemented or enforced by local governments or regional agencies, or any combination of local governments, regional agencies, or the State. Where possible within the time required..., the implementation plan required by this part shall be prepared by an organization of elected officials of local governments.... Where such an organization has not been designated by agreement within six months after the enactment of the Clean Air Act Amendments of 1977, the Governor..., after consultation with elected officials of local governments, ... shall designate an organization of elected officials of local governments in the affected area or a State agency to prepare such plan."

Section 175 of the Act authorizes full federal funding for the first two years of plan development. Section 325 authorizes the appropriation of $75,000,000 for these purposes, but no appropriation was made. The money actually available to local governments for this may be minimal.

Congress has also mandated certain economic sanctions (Section 176). For example, the Secretary of Transportation is not to approve any projects, nor award any grants, for projects in a non-attainment area where transportation control measures are necessary for attainment if the state by July 1, 1979 (July 1, 1982, if extension obtained) has not submitted a suitable implementation plan. Safety, mass transit, and transportation improvement projects can be approved if air quality improvement-related.

Attainment Areas

If an area falls into the attainment or unclassified categories, the SIP must then contain the requirements of Part C, Prevention of Significant Deterioration, Sections 160-169. This portion of the Act sets limits for how much deterioration in air quality in an area will be considered significant. Congress essentially followed EPA's regulatory scheme of 1975, and made it law.

V. SUMMARY

Designation of an area, or lack of data, results in application of provisions of the 1977 CAAA having far-reaching and rather long-term effects. The non-attainment plans will require stricter permit standards and restrictive emission limits for both new and existing sources (offset), increased local government involvement, and potential economic sanctions for transportation related projects. The PSD provisions mandate an extensive (and expensive) pre-construction review, restrictive emission limits, additional monitoring requirements, and the realization of means of limiting growth using air quality considerations.

APPENDIX D

Precision & Accuracy

APPENDIX D

Precision/Accuracy

1982 represents the first complete year the AQB compiled Precision and Accuracy (P&A) data, covering the performance of both TSP and gaseous samplers.

Precision applies to the repeatability of the instrument and is obtained by the use of collocated samplers (TSP) or the introduction of a known gas concentration on a weekly or oftener basis. Ninety-five percent confidence (probability limits) are then calculated from the average % difference and the standard deviation % difference. $PL=\overline{X}\pm 1.96\ S_D/\ 2$.

Accuracy implies just that. How accurate is the instrument? It is obtained through independent audits by the Quality Assurance Section of AQB. Probability limits are calculated as with precision data. $PL=\overline{X}+ 1.96\ SD$.

The EPA requires quarterly reports of the P&A data, as well as an annual SLAMS (State and Local Air Monitoring Sites) report which includes the P&A for SLAMS sites throughout the state.

Tables DI and DII summarize the P&A data by reporting agency and pollutant, quarterly and annually. Table DIII lists the audits performed in 1982 by site, giving dates and % difference. Collocated TSP sites are indicated by (+) preceding the site number.

Table DI

Precision TSP

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	1.65	2.57	4.00	2.32	2.63
SD % Diff	10.27	10.15	8.91	13.18	11.06
Upper Prob. Limit (UPL)	+15.88	+16.64	+16.35	+20.59	+17.96
Lower Prob. Limit (LPL)	-12.58	-11.50	- 8.35	-15.95	-12.70
No. of data pairs	20	28	26	44	118
No. readings <20 ug	2	0	0	0	2
No. of sites	3	3	3	3	3

Yellowstone Co. #002

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	2.74	0.63	-0.12	3.18	1.61
SD% Diff	4.48	3.97	2.82	5.39	4.17
Upper Prob. Limit (UPL)	8.95	6.13	3.79	10.65	7.39
Lower Prob. Limit (LPL)	-3.47	- 4.87	-4.03	- 4.29	-4.17
No. of data pairs	9	13	14	16	52
No. readings <20 ug	0	0	0	2	2
No. of sites	1	1	1	1	1

Cascade Co. #003

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	-5.96	0.46	7.65	5.17	1.83
SD% Diff	4.22	9.07	11.77	23.37	12.11
Upper Prob. Limit (UPL)	-0.11	13.03	23.96	37.56	18.61
Lower Prob. Limit (LPL)	-11.81	-12.11	- 8.66	-27.22	-14.95
No. of data pairs	13	10	10	13	46
No. readings <20 ug	3	0	0	2	5
No. of sites	1	1	1	1	1

Missoula Co. #004

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	5.37	1.50	-0.83	8.39	1.61
SD% Diff	20.74	18.14	12.48	10.04	15.35
Upper Prob. Limit (UPL)	34.11	26.64	16.47	22.30	22.88
Lower Prob. Limit (LPL)	-23.37	-23.64	-18.13	- 5.52	-19.66
No. of data pairs	19	31	38	37	125
No. readings <20 ug	6	10	4	10	30
No. of sites	3	3	3	3	3

Precision SO_2

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	-4.23	-4.71	-4.37	4.94	-2.09
SD% Diff	5.17	4.27	6.18	5.50	5.28
Upper Prob. Limit (UPL)	2.94	1.21	7.74	15.72	8.26
Lower Prob. Limit (LPL)	-11.40	-10.63	-12.94	-2.68	- 9.41
No. Checks	23	19	6	6	54
No. of sites	2	2	1	1	2

Precision CO

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	7.83	-0.69	2.31	5.74	3.80
SD% Diff	3.57	5.00	5.38	6.38	5.08
Upper Prob. Limit (UPL)	14.83	9.11	12.85	18.24	13.76
Lower Prob. Limit (LPL)	0.83	-10.49	-8.23	-6.76	6.16
No. Checks	13	8	14	6	41
No. of sites	1	1	1	1	1

Cascade Co. #003

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	0.57	-3.73	***	-1.61	-1.59
SD% Diff	4.19	2.40	***	6.32	4.30
Upper Prob. Limit (UPL)	8.78	-1.80	***	10.78	5.92
Lower Prob. Limit (LPL)	-7.64	-7.60	***	-14.00	-9.75
No. Checks	16	31	0	12	59
No. of sites	1	1	1	1	1

Missoula Co. #004

	Quarter				
	1st	2nd	3rd	4th	Annual
Avg. % Diff	2.55	2.97	***	0.52	2.01
SD% Diff	4.27	8.08	***	9.58	7.31
Upper Prob. Limit (UPL)	10.92	18.81	***	19.30	16.34
Lower Prob. Limit (LPL)	-5.82	-12.87	***	-18.36	-12.32
No. Checks	24	25	0	23	72
No. of sites	1	1	1	1	1

***Analyzer down - no points run

Precision - Lead

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Annual*
Avg. % Diff	--	88.89	10.17	9.91	10.04
SD% Diff	--	102.39	20.00	17.30	18.65
Upper Prob. Limit (UPL)	--	372.7	65.61	57.86	61.74
Lower Prob. Limit (LPL)	--	-194.9	-45.27	-30.65	-37.96
No. of data pairs	1	2	7	14	21
No. readings <0.15 ug	0	0	0	0	0
No. of sites	1	1	1	1	1

2. Accuracy SO_2

Air Quality Bureau #001

		Level 1	Level 2	Level 3	Level 4	Full Scale
1st Quarter	UPL	+12.12	+ 9.27	+ 5.99	--	+ 6.17
2 audits	LPL	- 4.54	-16.29	-12.75	--	-13.27
2nd Quarter	UPL	+13.66	+14.80	+ 9.99	--	+10.91
1 audit	LPL	-11.28	-14.88	-11.69	--	-12.45
Annual	UPL	+13.66	+14.80	+ 9.99	--	+10.91
3 audits	LPL	-11.28	-14.88	-11.69	--	-12.45

Note: Site discontinued June 30, 1982

3. Accuracy CO

Air Quality Bureau #001

		Level 1	Level 2	Level 3	Level 4	Full Scale
1st quarter	UPL	+27.81	+ 7.42	+ 1.52	--	+ 0.13
2 audits	LPL	- 2.25	+ 0.16	- 2.48	--	- 1.25
2nd Quarter	UPL	+28.59	+17.73	+10.59	--	+11.12
1 audit	LPL	+ 1.77	- 3.95	- 6.57	--	- 6.92
3rd Quarter	UPL	+19.05	+11.14	+13.14	--	+12.02
2 audits	LPL	+ 4.43	+10.64	+ 3.38	--	+ 5.08
4th Quarter	UPL	+21.26	+17.21	+11.65	--	+10.95
1 audit	LPL	+ 5.66	+ 7.45	+ 3.69	--	+ 6.05
Annual	UPL	+24.32	+19.14	+13.37	--	+14.36
6 audits	LPL	+ 4.32	+ 0.08	- 2.69	--	- 3.76

Cascade County #003

		Level 1	Level 2	Level 3	Level 4	Full Scale
1st Quarter	UPL	--	--	--	--	--
1 audit	LPL	--	--	--	--	--
2nd Quarter	UPL	+ 3.49	+ 4.18	+ 6.42	--	+ 5.92
1 audit	LPL	- 9.73	- 9.46	-13.30	--	-12.20
3rd Quarter	UPL	+18.62	+14.16	+13.94	--	+13.21
1 audit	LPL	-16.82	-14.14	-16.84	--	-15.61
4th Quarter	UPL	+19.25	+12.14	+16.18	--	+15.51
1 audit	LPL	-18.15	- 9.86	-21.64	--	-20.51
Annual	UPL	+10.88	+ 7.85	+ 9.27	--	+ 8.84
4 audits	LPL	-13.46	- 9.35	-15.43	--	-14.48

Missoula County #004

		Level 1	Level 2	Level 3	Level 4	Full Scale
1st Quarter	UPL	--	--	--	--	--
1 audit	LPL	--	--	--	--	--
2nd Quarter	UPL	+11.78	+ 8.78	+10.22	--	+10.00
1 audit	LPL	+ 9.04	- 0.74	- 4.80	--	- 5.28
3rd Quarter	UPL	+16.34	+ 2.27	+10.52	--	+ 9.93
1 audit	LPL	- 0.68	+ 2.24	- 4.94	--	- 5.25
4th Quarter	UPL	+12.79	+ 6.66	+28.81	--	+30.39
1 audit	LPL	-12.33	+ 0.21	- 5.33	--	- 6.81
Annual	UPL	+18.95	+ 7.11	+22.07	--	+22.84
4 audits	LPL	- 8.31	+ 0.34	- 7.63	--	- 8.69

Accuracy Lead

Air Quality Bureau #001

	Quarter				
	1st	2nd	3rd	4th	Avg.
UPL	+ 4.36	--	+10.49	--	+ 7.43
LPL	- 6.80	--	-18.82	--	-12.81
No. of Audits	5	0	3	--	8

TABLE DII

Accuracy TSP

Air Quality Bureau #001	1st Q	2nd Q	3rd Q	4th Q	Annual
Avg. % Diff	1.52	0.32	-0.59	4.03	0.18
SD % Diff	3.37	2.78	5.30	5.06	4.73
UPL(Upper Prob. Limit)	+ 8.13	+5.77	+9.80	+13.95	9.45
LPL(Lower Prob. Limit)	- 5.09	-5.13	-10.98	- 5.89	-9.09
# of Audits	17	5	33	3	58
Yellowstone County #002					
Avg. % Diff	2.07		-2.75	1.70	0.77
SD % Diff	3.42		0.21	2.55	3.27
UPL	+8.77		-2.34	6.70	7.18
LPL	-4.63		-3.16	-3.30	-5.64
# of Audits	4	0	2	2	8
Cascade County #003					
Avg. % Diff			1.6	2.13	2.02
SD % Diff				5.01	4.34
UPL				+11.95	10.53
LPL				- 7.69	- 6.49
# of Audits	0	0	1	4	5
Missoula County #004					
Avg. % Diff	2.29	-0.20	3.46	-1.93	1.39
SD % Diff	7.40	9.27	8.55	0.58	6.45
UPL	+86.79		+20.22	-0.79	14.03
LPL	-12.21		-13.30	-3.07	-11.25
# of Audits	6*	1	3	3	13

*2 audits (+63.5, -51.37) not included due to operator calibration error give $\bar{X}$=3.23; SD-31.38, UPL+64.73, LPL=-58.27

Other**					
Avg. % Diff		2.07	-3.82	-2.41	-2.97
SD % Diff		7.40	7.55	8.11	7.97
UPL		+16.57	10.98	+13.49	12.65
LPL		-12.43	-18.62	-18.31	-18.59
# of Audits	0	3	9	19	31

**Indian Reservation; industry, national park - data by site available by request

Table DIII

Site #	Site Name	Date	Results
0020 007	Anaconda Lincoln School	9/8	-2.7
0080 006	Billings, Lockwood School	1/12	+5.13
		11/15	-1.8
0080 007	Bilings KGHL	1/12	+6.0
		9/1	-2.6
0080 008	Billings City Hall Rptg	1/12	+6.0
		9/1	-2.6
0080 009	Billings Grand Ave. School	1/12	+3.78
		11/17	-0.1
0080 061	Billings Metra Fairgrounds		
0080 062	Billings Taft SchoolE Rptg	1/12	+0.39
		5/24	-2.9
		5/25	-1.56
		8/31	-4.2
		11/15	+7.3
0080 062	Billings Taft School W Colo	1/2	+1.66
		5/24	+2.4
		5/25	+3.85
		8/31	-2.1
		11/15	+6.6
0080 063	Billings Shawnee Park		
0080 064	Billings No. Johnson Lane SO2		
0080 065	Billings Lockwood Park SO2		
0080 066	Billings Coburn Road SO2		
0120 001	Bozeman Traphagen	9/3	+1.7
0120 002	Bozeman E. Main City Bldg	9/3	-3.7
0120 005	Bozeman Whittier School	9/3	-2.6
0160 005	Butte Greeley Sch. #1 Rptg	1/5	+2.87
		9/3	-0.8
0160 005	Butte Greely Sch. #2 Colo	1/5	+1.67
		9/8	-4.9
0160 018	Butte Hebgen Park	1/5	+9.83
		9/8	-1.7
0160 019	Butte Dr. Canty	1/5	+9.83
		9/8	+1.6
0160 029	Butte Walkerville, Blaine School	1/5	+2.73
		9/8	+0.7
0270 005	Col. Falls - Anders	7/9	-13.1
0340 001	Scobey-Border Site	7/1	+17.1
0340 002	Scobey-Richardson		
0340 004	Scobey Hanrahan		
0480 029	Flathead Co.-NAAC	7/8	+1.1
0480 035	Flathead Co.Polebridge RS	7/8	+5.4
0480 036	Flathead Co. Big Fork RS	7/7	+0.45
0480 037	Flathead Co. Whitefish	7/9	-0.3
0480 304	Flathead Co. Airport	7/7	+4.7
0540 002	Garfield Co. Jordan		

Site	Site Name	Date	Results
0570 007	Glacier NP-W. Glacier	7/8	-2.0
		9/13	-2.8
0570 010	Glacier NP-St. Mary's		
0600 001	Glendive-College	7/2	-2.2
		8/24	
0600 002	Glendive Medical Arts Center		
0660 009	Great Falls-FS#1	11/30	+2.4
0660 017	Gt.Falls Downtown W Rptg	11/30	+2.7
0660 017	Gt.Falls Downtown E Colo	11/30	+7.8
0660 019	Gt.Falls Black Eagle PO	11/30	+7.8
0660 020	Gt.Falls Lincoln School	9/29	+1.6
0660 021	Gt.Falls Federal CO		
0700 001	Havre City Bldg.	2/26	-0.60
		(2/26	-0.51)
		9/13	-3.9
0720 001	Helena Cogswell Bldg	3/1	+0.02
		(3/1	+2.80)
		7/27	+3.1
0720 013	Helena Capital Courts		
0720 015	Helena Super Save		
0720 016	Helena Cooney Home		
0760 903	Jefferson Co. MT. City School		
0800 015	Kalispell UA	7/9	-1.0
0800 017	Kalispell Courthouse		
0820 010	Lake Co. Polson	7/9	+1.2
0820 012	Lake Co. Ninepipe	7/9	+10.5
0820 017	Lake Co. Swan River	4/9	-0.21
		7/7	-3.7
0840 001	Laurel Jr. High	1/12	-0.14
0840 014	Laurel New Farm	1/11	+4.42
0860 002	L&C Co. Hastie	7/26	-6.6
0860 716	L&C Co. South	7/26	-7.8
0860 719	L&C Co. Hadfield (Rptg)		
0860 719	L&C Co. Hadfield (Colo)		
0860 722	L&C Co. Dartman	7/26	+1.9
0880 002	Lewistown	2/25	-3.83
		(2/25	-1.75)
0900 010	Libby-Brown	9/14	+2.9
1040 003	Miles City PCA	7/2	-6.7
		8/24	
1080 005	Missoula MFJSE CO		
1100 001	Msla Courthouse Roof Rpt R	3/31	-10.47
		11/17	- 2.6
1100 001	Msla Courthouse Roof Rpt L	3/31	+6.95
		11/17	-1.6
1100 001	Msla Courthouse Roof Colo	3/31	+5.5
		11/17	-1.6
1100 015	Msla HW#1 Rptg		
1100 015	Msla HW#1 Colo		
1100 016	Msla HW #2		
1100 020	Msla Rose Park Rpt R	3/31	+63.5
		7/9	+12.4
1100 020	Msla Rose Park Rpt L	3/31	-51.37
		7/9	-6.1
1100 020	Msla Rose Park Colo	3/31	+918
		7/9	+4.08

Table DIII, Cont.

Site #	Site Name	Date	Results
1100 024	Msla Boyd Park TSP	3/31	-2.13
		4/14	-0.2
1100 024	Msla Northside		
1100 026	Missoula Co - Lolo		
1260 024	Powell Co. Ovando	2/25	-2.79
		(2/25	-0.88)
		7/7	-3.6
1320 010	Richland Co. Sidney Downtown		
1400 003	Sanders Co. Thompson Falls Courthouse		

Parentheses ( ) designate 2nd audit after recalibration

APPENDIX E

List of Air Quality Reports

APPENDIX E

List of MAPS Technical Reports

Health Effects

1. Johnson, K; Schwaller, R; Wing, B. et al. Pulmonary Function Testing of Patients with Chronic Obstructive Pulmonary Disease (September 1979).

2. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Wing, B. et al. Pulmonary Function Testing of Elementary School Children (October 1979).

3. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Medvec, S.; Simms, M. et al. Relationship Between Human Health and Inhalable Particulates (October 1980).

4. Warren, G.; Rogers, S.; and Medvec, S. Mutagen Screening in an Isolated High Lung Cancer Mortality Area of Montana (June 1979).

Air Quality

1. Gelhaus, J., Air Quality Data Summaries for Anaconda-Butte, Billings, Missoula, and Columbia Falls/Hardin/East Helena/Colstrip (February 1981).

2. Robbins, H.; Driscoll, P.; Myren, B. et al. Air Monitoring Instrumentation (October 1979).

3. Rockwell Int. et al. Final Report for Laurel-Billings SO_2 Study, 1982.

Meteorology/Modeling

1. Gelhaus, J. et al. Meteorological Summary - First Year (July 1979).

2. Gelhaus, J. and Harner, S. Deer Lodge Valley Dispersion Study (July 1979).

3. Gelhaus, J. Meteorological Summary - Billings (February 1981).

4. Gelhaus, J., Machler, M., and Stewart, T. Montana Air Resources Modeling System (August 1979).

5. Middlemist, T.; Robbins, H; and Zimmerman, L. Missoula Valley Dispersion Study (September 1980).

6. Nelson, B.; Machler, M; and Robbins, H. Deer Lodge Valley Dispersion Study (October, 1980)

Emission Inventory

1. Bohn, R.; Cowherd, C.; Keller, R; and Raisch, R. Update and Improvement of the Emission Inventory for MAPS Study Areas (November 1979).

2. Raisch, R.; Williams, G.; Bohn, R.; and Cowherd, C. A Study of the Feasibility of Performing an Inventory of Historical Emissions at Butte and Anaconda, Montana (November 1979).

Systems Design

1. Lynn, D. et al. Computer Information System Development (November 1979).

APPENDIX E

LIST OF AIR QUALITY REPORTS

Maughan, D.; Sternberg, S. A Network Review of Montana's Ambient Air Monitoring (April, 1979).

Machler, M.; Robbins, H. 1980 Network Review (October, 1980).

Raisch, R.; Robbins, H. 1981 Network Review (November, 1981)

Raisch, R.; Robbins, H. 1982 Network Review (April, 1982)

McAllister, D.; Ruby, M.; Vichorek, D.; Crowley, F. Final Environmental Impact Study, Montana Ambient Air Quality Standards Study (February, 1980).

Gelhaus, J.; Machler, M.; Schwartz, S.; Roach, M. Background Air Quality Studies of the Poplar River Area of Northeastern Montana, 1978 (August, 1979).

Gelhaus, J.; Machler, M. Meteorological Study, Columbia Falls, Montana (March, 1979).

Robbins, H., et al. Montana Quality Assurance Manual (December, 1980).

Coefield, J. et al. Flathead River Basin Environmental Impact Study - Interim Annual Report for July 1979 through September 1980 (June 1980).

Coefield, J. et al. Flathead River Basin Environmental Impact Study - Interim Annual Report for September 1980 to December 1981 (May 1983).

Erickson, R.; Tomlinson, W.; Steffel, R.; Baxter, T. Survey of Residential Wood Use in Helena, Bozeman, Great Falls, and Kalispell, Montana (June, 1981).

Houck, J. et al. East Helena Source Apportionment Study (Sept. 1982)

State of Montana Air Quality Rules (August 1980)

Clean Air Act of Montana (July 1979)

APPENDIX F

Point Source Emission Estimates

APPENDIX F

POINT SOURCE EMISSION ESTIMATES

The following two tables list emission estimates from various industrial sources in the state. Table AP-F-I lists sulfur dioxide emissions; Table AP-F-II lists particulates.

Table AP-F-I
POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES FOR 1982

Source	SO_2 Tons/Yr	County	City
Exxon Co., USA	16313	Yellowstone	Billings
Montana Power Co. (Corette)	9811	Yellowstone	Billings
Farmers' Union CENEX	8233	Yellowstone	Laurel
Continental Oil Co.	3878	Yellowstone	Billings
Montana Sulfur	2130	Yellowstone	Billings
Great Western Sugar	855	Yellowstone	Billings
Westmoreland Resources	* 61	Big Horn	Hardin
East Decker Coal	* 42	Big Horn	Decker
Spring Creek Coal	* 27	Big Horn	Decker
West Decker Coal	* 20	Big Horn	Decker
Simmons Refinery	1330	Cascade	Great Falls
WESTCO	1157	Glacier	Cut Bank
Union Oil of California	222	Glacier	Cut Bank
Rainbow Resources	203	Glacier	Browning
ASARCO	28740	Lewis & Clark	East Helena
Ideal Basic Industries	421	Gallatin	Trident
Kaiser Cement	335	Jefferson	Montana City
Anaconda Co. Butte Operations	* 50	Silver Bow	Butte
Montana Power Colstrip 1&2	5262	Rosebud	Colstrip
Oil and gas flaring	5000	Williston Basin**	
Montana Dakota Utilities	3843	Richland	Sidney
Shell Oil	1163	Richland	Sidney
Perry Petrolane	274	Richland	Sidney
American Colloid	63	Phillips	Malta
KENCO	55	Roosevelt	Wolf Point
Western Energy Coal	* 52	Rosebud	Colstrip
Peabody Coal	* 18	Rosebud	Colstrip
ARCO Aluminum	3551	Flathead	Columbia Falls
Champion Int., Packaging Div.	1432	Missoula	Frenchtown
W. R. Grace	109	Lincoln	Libby
Burlington Northern tie plant	42	Sanders	Paradise
Stoltze/Conner	42	Ravalli	Darby
St. Regis Paper	33	Lincoln	Libby

*Includes tailpipe emissions from diesel powered vehicles.
**Estimated emissions for oil field gas flaring in the Williston Basin.

Table AP-F-II

POINT SOURCE PARTICULATE EMISSION ESTIMATES FOR 1982

Source	Part. Tons/Yr	County	City
Exxon Co. USA	1466	Yellowstone	Billings
Continental Oil Co.	1320	Yellowstone	Billings
Montana Power Co. (Corette)	1094	Yellowstone	Billings
East Decker Coal	*1008	Big Horn	Decker
Westmoreland Resources	* 761	Big Horn	Hardin
Cenex	746	Yellowstone	Billings
West Decker Coal	* 718	Bighorn	Decker
Spring Creek Coal	* 554	Bighorn	Decker
Great Western Sugar	243	Yellowstone	Billings
Bighorn Calcium	* 240	Big Horn	Warren
Kaiser Cement	*1977	Jefferson	Montana City
Anaconda Co. Butte Operations	*1657	Silver Bow	Butte
ASARCO smelter	717	Lewis&Clark	East Helena
Ideal Basic Industries	* 418	Gallatin	Trident
Stauffer Chemical Co.	410	Silver Bow	Ramsay
Pfizer Talc	175	Beaverhead	Dillon
Cyprus Industrial Minerals	115	Gallatin	Three Forks
Louisiana Pacific Corp.	58	Powell	Deer Lodge
Western Energy	*2862	Rosebud	Colstrip
Montana Power Co. 1&2	989	Rosebud	Colstrip
Peabody Coal	* 500	Rosebud	Colstrip
Montana Dakota Utilities	447	Richland	Sidney
Knife River Coal	* 150	Richland	Savage
Northern Cheyenne Forest Prod.	* 126	Rosebud	Ashland
Holly Sugar	86	Richland	Sidney
St. Regis Paper Co.	824	Lincoln	Libby
Missoula White Pine & Sash	* 571	Missoula	Missoula
Champion Int.	480	Missoula	Frenchtown
Champion	388	Missoula	Bonner
Louisiana Pacific	374	Missoula	Missoula
Plum Creek Lumber	* 238	Lake	Pablo
Flathead Lumber	225	Lake	Polson
Plum Creek Lumber	204	Flathead	Columbia Falls
Plum Creek Lumber	189	Flathead	Kalispell
Flodin Lumber	* 180	Sanders	Thompson Falls
W. I. Forest Prod. Inc.	* 122	Sanders	Thompson Falls
American Timber	* 113	Flathead	Olney
Stoltz Land & Lumber	* 97	Flathead	Columbia Falls
Louisiana Pacific	* 93	Sanders	Trout Creek
Champion Int.	78	Missoula	Missoula
Ksanka Lumber	* 67	Lincoln	Fortine
ARCO Aluminum	55	Flathead	Columbia

*Fugitive emissions associated with mining and vehicle traffic are included.

APPENDIX G

Prevention of Significant Deterioration

APPENDIX G

PREVENTION OF SIGNIFICANT DETERIORATION

Prevention of Significant Deterioration (PSD) requirements were first introduced as part of the 1977 Amendments to the Clean Air Act.

These PSD requirements set limits for increases in ambient pollution levels and established a system for preconstruction review of new major sources. Three PSD classes have been established. Class I permits very small increases in pollution; Class II allows somewhat larger increases; and Class III allows the air quality to "deteriorate" considerably more. In general, Class I is designed for "pristine" areas where almost any deterioration would be significant. Congress established several types of mandatory Class I areas. These mandatory areas include international parks, wilderness areas larger than 5000 acres, national memorial parks larger than 5000 acres, and existing national parks larger than 6000 acres. All other areas of the country classified as attainment are Class II. Class II limits allow for moderate, well-controlled growth and Class III limits allow pollutant levels to increase considerably.

Table AP-G-I shows the allowable increases for the various classes. Table AP-G-II lists the federal Class I areas for Montana and Figure AP-1-G shows the locations of these areas on a map of Montana.

In 1978 the state of Montana established its own PSD rules. These rules were closely patterned after the Federal rules. In 1979 the EPA was sued by the Alabama Power Company over the Federal PSD rules. The court ruled that EPA had misinterpreted the intent of Congress. As a result the EPA rewrote their rules, which then differed from Montana's rules. The significant difference between the two sets of rules is that the state counted fugitive dust and uncontrolled plant emissions as part of the increment consumption.

Since 1979 the Air Quality Bureau has proceeded with rule-making to adopt an amended PSD rule which resembles the modified EPA rule. Final adoption of the Montana rule occurred January 28, 1983. EPA approved the new rule June 6, 1983 and delegated the entire responsibility for PSD to the state of Montana.

Table AP-G-I

FEDERAL PREVENTION OF SIGNIFICANT DETERIORATION
ALLOWABLE INCREMENTS
Micrograms Per Cubic Meter

	I	II	III	Not to exceed
Particulates				
Annual Geo. Mean	5	19	37	75
Maximum 24-hour	10	37	75	150
Sulfur Dioxide				
Annual Arith. Mean	2	20	40	80
Maximum 24-hour	5	91	182	365
Maximum 3-hour	25	512	700	1300

Table AP-G-II

MONTANA FEDERAL CLASS I AREAS

Area	Location
Glacier National Park	NE Kalispell
Yellowstone National Park	S Bozeman
Bob Marshall Wilderness Area	SE Kalispell
Anaconda-Pintlar Wilderness Area	SW Anaconda
Selway-Bitterroot Wilderness Area	W Hamilton
Cabinet Mountains Wilderness Area	S Libby
Scapegoat Wilderness Area	NW Helena
Gates of the Mountains Wilderness Area	NE Helena
Mission Mountains Wilderness Area	SE Polson
Red Rock Lakes National Wildlife Refuge	S Virginia City
Medicine Lake National Wildlife Refuge	S Plentywood
U. L. Bend National Wildlife Refuge	SW Glasgow
Northern Cheyenne Reservation	SE Hardin
Flathead Indian Reservation	Near Polson & Ronan

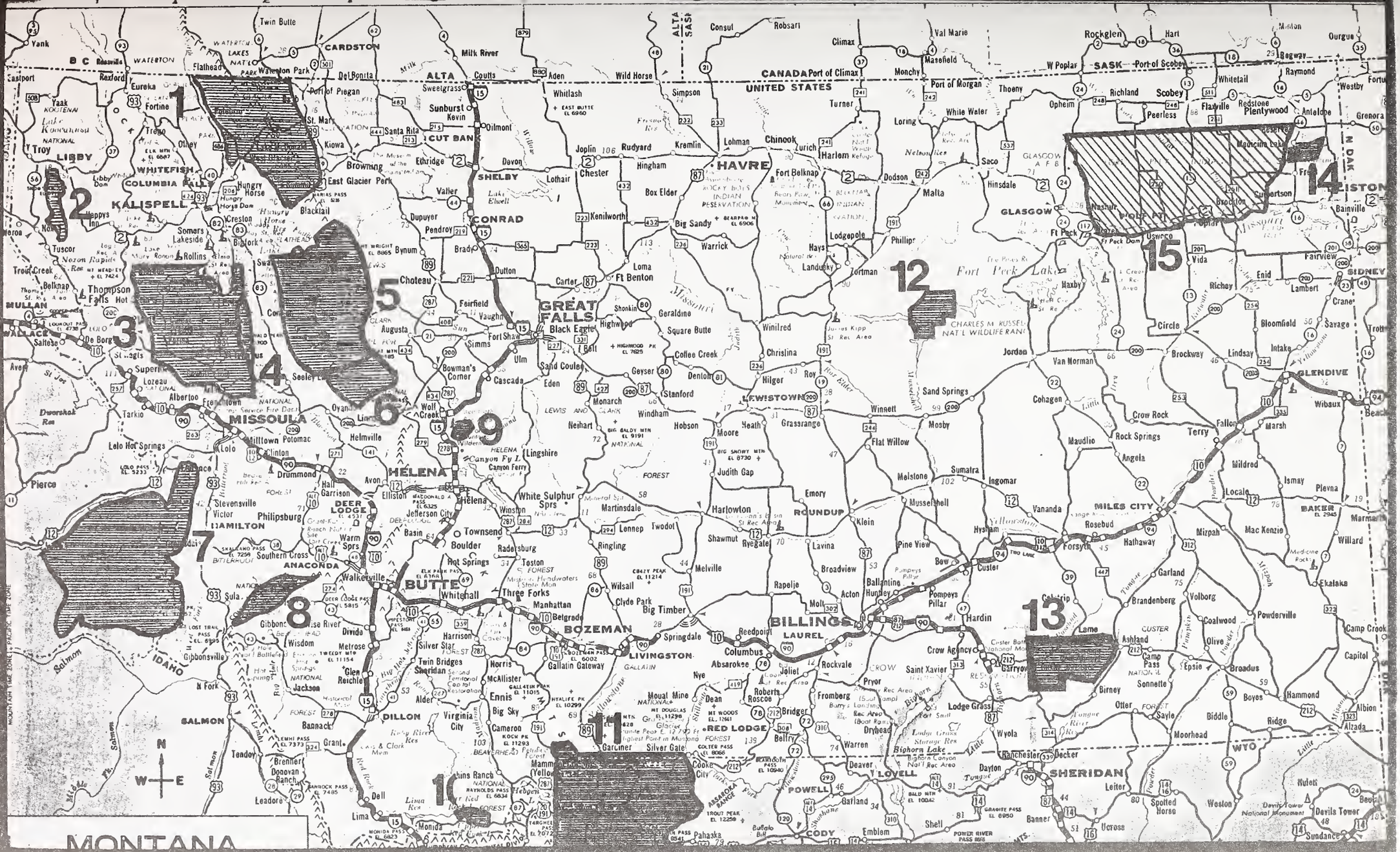


Figure AP-1-H
PSD CLASS I AREAS IN MONTANA

1. Glacier National Park
2. Cabinet Mountain Wilderness
3. Flathead Indian Reservation
4. Mission Mountain Wilderness
5. Bob Marshall Wilderness
6. Lincoln Scapegoat Wilderness
7. Selway Bitterroot Wilderness
8. Anaconda Pintlar Wilderness
9. Gates of the Mountains Wilderness
10. Red Rock Lakes National Wildlife Refuge
11. Yellowstone National Park
12. U L Bend Wilderness Area
13. Northern Cheyenne Indian Reservation
14. Medicine Lake National Wildlife Refuge
15. Fort Peck Indian Reservation (proposed)

APPENDIX H

Fugative H_2S Emissions from a Canadian Gas Well

On October 17, 1982, an Amoco gas well that was being drilled near Lodgepole, Alberta Canada went out of control. The well is located 80 miles north of Calgary and 450 miles north of Helena. A spark caught the well on fire and it burned for about two weeks. After the fire was extinguished, the sour gas 20-30 million ft^3/day with 20 to 30 percent of hydrogen sulfide (H_2S) was vented to the atmosphere from a nine and one-half inch ground level pipe.

The H_2S emissions in Edmonton exceeded the standard by a factor of 50 times or more. The highest hourly average of H_2S in ppm was recorded at Edmonton at 0.53 ppm. This was the nearest continuous monitor to the well site. The highest hourly average at Calgary was 0.1 ppm. The H_2S ambient standard in Alberta is 0.01 ppm. It looks as though the Montana standard of 0.05 ppm for H_2S probably was not violated. During this period of well venting, the weather conditions were such that large amounts of H_2S were transported 300 miles or more south to Montana on several occasions.

On one of these occasions, November 1, 1982, when H_2S odor (rotten eggs) was quite evident in many communities of Montana from St. Mary's to Bozeman, the AQB hi-vol network was operating. The State Air Quality Bureau did not operate any continuous H_2S monitors in Montana at this time. Twenty-five of the hi-volume samples taken on November 1, 1982 were analyzed for sulfate content. Two run periods prior to the H_2S episode October 20 and 27, 1982 and one run after the H_2S episode, November 7, 1982, were also analyzed for sulfates. Table I shows the mg sulfate per gram TSP for all sites on the four run days.

Regression analysis for mg SO_4/g TSP vs miles from surce were performed. Logrithmic, power, linear and exponential curves were fit to the data set and Table II shows the results. The curve fitting shows no correlation between distance from source and sulfate concentrations in any of the four curve forms explored. Table II summarizes the slope, intercept and correlation.

coefficient for each set of data. The form of each curve fitted is also shown in Table II.

In conclusion, there was no significant correlation between sulfate on the hi-vol samples and distance from the well head. Therefore, most of the sulfate observed probably came from sources other than the gas well in Alberta.

TABLE I

	Miles from Edmonton	October 20 Total g TSP	October 20 mg SO4	October 20 mg/g TSP	October 26 Total g TSP	October 26 mg SO4	October 26 mg SO4 g TSP	November 1 Total g TSP	November 1 mg SO4	November 1 mg SO4 g TSP	November 7 Total g TSP	November 7 mg SO4	November 7 mg SO4 g TSP
St. Mary's	330	0.0094	0.879	93.5	--			0.0033	2.06	624.2			
Polebridge	322	0.0358	0.482	13.5	0.0160	0.241	15.06	0.0177	0.307	17.3	--	--	--
West Glacier	336	0.0091	0.098	10.77	0.0197	0.1306	6.63	0.0067	0.124	18.4	0.0119	0.139	11.7
Whitefish	355	0.1562	0.118	0.76	0.0732	0.067	0.915	0.0750	0.259	3.45	0.0644	0.035	0.54
Kalispell-GIA	360	0.1034	0.195	1.89	0.0282	0.074	2.62	0.0207	0.294	14.2	0.0260	0.038	1.46
Kalispell-Univ. Ath.	360	0.1356	0.275	2.03	0.0727	0.177	2.43	0.1154	0.257	2.23	0.0812	0.209	2.57
Kalispell-Evergreen	360	0.2051	0.143	0.70	0.0592	0.113	1.91	0.0704	0.137	1.95	0.0577	0.0040	0.69
Libby Brown	363	0.2262	0.631	2.34	0.1319	0.306	2.32	0.1409	0.427	3.03	0.1835	0.448	2.44
Bigfork	368	0.0545	0.240	4.40	0.0329	0.209	6.35	0.0288	0.097	3.37	0.0232	0.119	5.13
Swan River	379	0.0305	0.180	5.90	0.0102	0.535	52.5	0.0085	0.268	31.53	0.1642	0.242	1.47
Polson-MAL	395	0.1307	0.199	1.52	0.0425	0.126	2.96	0.0515	0.147	2.85	0.0512	0.133	2.60
Ronan-Ninepipes	405	0.0322	0.059	1.83	0.0110	0.039	3.55	0.0112	0.059	5.27	0.0177	0.0405	2.29
Gt. Falls Lib. W	418	0.1327	0.614	4.63	--	--		0.0424	0.558	13.16	0.0651	0.496	7.62
Gt. Falls FS#1	418	0.2933	0.525	1.79	0.1222	0.686	5.61	0.1418	1.323	9.33	0.1531	0.580	3.79
Gt. Falls Black Eagle	418	0.1908	0.763	3.99	0.0848	1.606	17.88	0.1038	1.476	14.22	0.1100	1.228	11.16
Ovando-Smith	438	0.0223	0.055	2.47	0.0044	0.056	12.73	0.0104	0.056	5.38	0.0109	0.0385	3.53
Helena Cogswell	475	0.0850	0,845	9.94	0.0411	0.892	21.7	0.0251	0.510	20.3	0.0535	0.336	6.28
Butte Greeley	510	0.2108	0.356	1.69	0.0676	0.366	5.41	0.0694	0.349	5.03	0.1735	0.364	2.10
Butte Hebgen	510	0.2131	0.440	2.06	0.0542	0.358	6.61	0.0794	0.391	4.92	0.1922	0.345	1.795
Butte Dr. Canty	510	0.7275	0.218	1.71	0.0403	0.232	5.75	0.0527	0.221	4.19	0.1067	0.345	3.23
Bozeman City Bldg.	547	0.1332	0.416	3.12	0.1223	0.512	4.19	0.0998	0.568	5.69	0.0859	0.452	5.26
Jordan	509	0.0043	0.451	104.9	0.0178	0.505	28.4	0.0096	0.315	32.81	--	--	--
Scobey Border	467	0.0082	0.677	82.6	0.0259	0.565	21.8	0.0273	0.733	26.8	0.0182	0.876	48.1
Scobey Richardson	473	0.0260	0.925	35.6	0.0397	0.695	17.5	0.0204	0.732	35.88	0.0189	0.631	33.4
Scobey Hanrahan	473	0.0122	0.731	59.9	0.0461	0.704	15.3	0.0158	0.433	27.4	0.0132	0.382	28.94

TABLE II

Paired Sets - Equation Oct. 20 vs. miles	Slope	Intercept	Correlation Coefficient R
Power	1.25968	0.0027	0.1323
Exp	0.00092	3.73	0.0803
Linear	0.0753	-13.5	0.1604
Log	29.6	-160.3	0.1494
Oct. 26 vs miles			
Power	2.231	0.00001	0.3479
Exp	0.00510	0.8153	0.338
Linear	0.02534	0.5675	0.14346
Log	11.64	-58.96	0.1551
Nov. 1 vs. miles			
Power	-4.756	180.7	0.060
Exp	-0.00091	15.05	0.0484
Linear	-0.48078	239.2	0.2625
Log	0.7233	33.09	0.00548
Nov. 7 vs. miles			
Power	2.42	1.67×10^{-6}	0.328
Exp	0.0067	0.2463	0.355
Linear	0.0556	-15.1283	0.282
Log	25.2	-143.8	0.297

Equation Forms

Power	$y=ax^b$
Exponential	$y = ae^{bx}$
Linear	$y = bx+a$
Logrithmic	$y = a+b\ln x$

APPENDIX I

Air Quality Data Outputs

APPENDIX I

AIR QUALITY DATA OUTPUTS

This appendix has been put together to show the data user the varieties of data outputs.

The Bureau uses an adaptation of the EPA's Comprehensive Data Handling System (CDHS). This system has two subsystems: Air Quality Data Handling System (AQDHS) and Emission Inventory System/Permits and Registration (EIS/P&R).

The following outputs are generated by AQDHS, EIS/P&R, and other systems that have been programmed to our needs. They are listed as follows:

AQDHS Daily

AP-1-I Swan River - NO_3 1982
AP-2-I Polson - MAL - TSP 1982
AP-3-I Bigfork - TSP 1982

AQDHS Hourly

AP-4-I Billings - Coburn Road - SO_2 August 1982
AP-5-I Billings - Coburn Road - Wind Direction - March 1982
AP-6-I Billings Lockwood Park - Wind Speed - May 1982

Upper Air Summary

AP-7-I Flathead County - Airport - 100 M Winds - June 1982

Acoustic Radar Summary

AP-8-I Billings Vo Tech - Two-Hour Stability Analysis, April 1982

TSP Plots

AP-9-I Butte - Greeley School - TSP - Three Year Plot - 1980-1982
AP-10-I Columbia Falls - Anders - TSP - Three Year Plot - 1980-1982
AP-11-I Columbia Falls - Anders - TSP - One Year Plot - 1982
AP-12-I Swan River Youth Camp - TSP - One Year Plot - 1982

SO_2 Plot - Diurnal

AP-13-I Missoula - Malfunction Junction CO (Monday-Friday) December 1982

Surface Wind Rose

AP-14-I Flathead County Airport - Monthly Wind Roses - September-December 1982

EIS/P&R Summary Report

AP-15-I Sawmill - (Name Deleted) - Emission Estimates - Wood Waste Burner
Note: This report lists point sources and pollutant emission estimates from industries in the state.

Figure AP-1-I

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT
REPORT DATE: 03/24/83 PAGE 2359

PARAMETER: NITRATE (12306) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: .05 DECIMAL CODE: 1
COLLECTION METHOD: HI-VOL (92) ANALYSIS METHOD: REDUCTION-DIAZO COUPLING SAMPLING INTERVAL: DAILY

SITE: LAKE CO - SWAN RIVER - HV.MET 12/81 (0820-017) AGENCY: STATE (F)
PROJECT: SPECIAL STUDIES (05) YEAR: 1982 MONTH:

MONTANA STANDARD:
FEDERAL PRIMARY STANDARD:
FEDERAL SECONDARY STANDARD:

DAY	JAN	FEB	MAR	APR	MAY	MONTH JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01											0.1	0.1	2	0.1	0.1
02									0.4	0.0			2	0.2	0.4
03								0.1					1	0.1	0.1
04						0.3	0.3						2	0.3	0.3
05	0.2			0.0	0.0								3	0.1	0.2
06		0.0	0.0										2	0.0	0.0
07											0.1	0.2	2	0.2	0.2
08									0.4	0.0			2	0.2	0.4
09								0.3					1	0.5	0.5
10		0.0				0.4	0.5						3	0.3	0.5
11	0.0			0.0	0.0								3	0.0	0.0
12			0.0										1	0.0	0.0
13											0.0	0.1	2	0.1	0.1
14									0.2	0.2			2	0.2	0.2
15								0.2					1	0.2	0.2
16		0.0				0.4	0.3						3	0.2	0.4
17	0.0			0.0	0.0								3	0.0	0.0
18															
19															
20											0.0	0.0	2	0.0	0.0
21									0.3	0.2			2	0.3	0.3
22		0.0						0.4					1	0.4	0.4
23	0.0			0.0	0.0	0.4	0.2						3	0.2	0.4
24													3	0.0	0.0
25															
26											0.2	0.1	2	0.2	0.2
27										0.0			1	0.0	0.0
28		0.0					0.4	0.5					1	0.5	0.5
29				0.0	0.3								2	0.2	0.4
30			0.0										2	0.2	0.3
31													1	0.0	0.0
												0.1	1	0.1	0.1
NO	4	5	3	5	5	4	5	5	4	5	5	6	56		
MEAN	0.1	0.0	0.0	0.0	0.1	0.4	0.3	0.3	0.3	0.1	0.1	0.1		0.1	
MAX	0.2	0.0	0.0	0.0	0.3	0.4	0.5	0.5	0.4	0.2	0.2	0.2			0.5

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

Figure AP-2-I

AIR QUALITY DATA REPORT — REPORT DATE: 03/24/83 — PAGE 1716

PARAMETER: SUSPENDED PARTICULATE (11101) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: HI-VOL (91) ANALYSIS METHOD: GRAVIMETRIC SAMPLING INTERVAL: DAILY

SITE: LAKE CO - POLSON (MAL) - HIVOL (0820-010) AGENCY: STATE
PROJECT: SPECIAL STUDIES (05) YEAR: 1982 MONTH: (F)

MONTANA STANDARD: 000200MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL PRIMARY STANDARD: 000260MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 000150MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01											28	27	2	28	28
02									85	34			2	60	85
03								29					1	29	29
04		53					33						2	43	53
05	36			22	63								3	40	63
06			46										1	46	46
07											31	51	2	41	51
08									92	39			2	66	92
09								27					1	27	27
10		67				71	45						3	61	71
11	35			19									2	27	35
12			36										1	36	36
13											27	30	2	29	30
14									18	71			2	45	71
15								16					1	16	16
16		23				29	23						3	25	29
17	22			28	28								3	26	28
18			25										1	25	25
19											18	27	2	23	27
20									72	72			2	72	72
21								66					1	66	66
22		61				35	82						3	59	82
23	34			72	29								3	45	72
24			28										1	28	28
25											34	39	2	37	39
26									13	24			2	19	24
27								84					1	84	84
28		52				26	95						3	55	95
29	20			100	23								3	48	100
30			20										1	20	20
31												38	1	38	38
NO	5	5	5	5	4	4	5	5	5	5	5	6	59		
MEAN	29	51	31	48	36	40	56	44	56	48	28	35		42	
MAX	36	67	46	100	63	71	95	84	92	72	34	51			100

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

GMEAN 28.51 48.15 29.71 38.47 32.93 36.99 48.41 37.01 42.06 43.88 26.99 34.33 YTD-GMEAN 36.28

Figure AP-3-I

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 03/24/83 — PAGE 1095

PARAMETER: SUSPENDED PARTICULATE (11101) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: HI-VOL (91) ANALYSIS METHOD: GRAVIMETRIC SAMPLING INTERVAL: DAILY

SITE: FLATHEAD CO - BIGFORK - HIVOL (0480-036) AGENCY: STATE
PROJECT: SPECIAL STUDIES (05) YEAR: 1982 MONTH: (F)

MONTANA STANDARD: 000200MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL PRIMARY STANDARD: 000260MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 000150MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01											15	46	2	31	46
02									29	14			2	22	29
03								17					1	17	17
04		52				16	13						3	27	52
05				27	36								2	32	36
06			40										1	40	40
07											12	65	2	39	65
08									33	23			2	28	33
09								23					1	23	23
10						34	28						2	31	34
11	32			9	28								3	23	32
12			80										1	80	80
13											19		1	19	19
14									16	40			2	28	40
15								14					1	14	14
16		8				31	14						3	18	31
17	14			15	33								3	21	33
18			28										1	28	28
19											8	22	2	15	22
20									45	27			2	36	45
21								40					1	40	40
22		48				35	38						3	40	48
23	35				13								2	24	35
24			46										1	46	46
25											24	35	2	30	35
26									9	17			2	13	17
27								44					1	44	44
28		54				19	78						3	50	78
29	8			33	16								3	19	33
30			14										1	14	14
31												42	1	42	42
NO	4	4	5	4	5	5	5	5	5	5	5	5	57		
MEAN	22	41	42	21	25	27	34	28	26	24	16	42		29	
MAX	35	54	80	33	36	35	78	44	45	40	24	65			80

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

GMEAN	18.41	32.22	35.60	18.62	23.33	25.70	27.27	24.93	22.82	22.61	14.57	39.54	YTD-GMEAN	24.51

Figure AP-4-I

SITE: BILLINGS - COLUMBIA ROAD - MONROE - SO2 STUDY 0281 (05) 10080-0881 AGENCY: STATE

PROJECT: SPECIAL STUDIES YEAR: 1982 MONTH: (8) AUGUST

MONTANA STANDARD: 00.500PARTS PER MILLION-1 HR MAX-1 PER YEAR
FEDERAL PRIMARY STANDARD: 00.140PARTS PER MILLION-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 00.500PARTS PER MILLION-3 HR MEAN-1 PER YEAR

DAY	HOUR																									
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG	MAX
01	.010	.012	.039	.013	.015	.013	.016	.020	.076	.047	.011	.007	.019	.001	.001	.000	.000	.026	.022	.004	.004	.001	.003	.001	.015	.076
02	.017	.037	.014	.006	.003	.003	.004	.002	.000	.000	.000	.000	.007	.000	.008	.025	.020	.020	.018	.001	.000	.001	.074	.013	.011	.074
03	.005	.005	.022	.022	.012	.014	.014	.011	.014	.005	.007	.004	.022	.001	.000	.000	.000	.001	.001	.005	.005	.037	.039	.001	.010	.039
04	.000	.002	.004	.012	.057	.066	.011	.041	.033	.010	.019	.014	.024		.033	.020	.003	.000	.018	.015	.085	.011	.003	.000	.021	.085
05	.000	.002	.005	.006	.020	.039	.015	.028	.019	.004	.018	.011	.044	.070	.020	.008	.003	.002	.009	.060	.055	.028	.000	.048	.021	.070
06	.017	.008	.007	.005	.005	.008	.035	.037	.041	.040	.011	.003	.007	.011	.006	.005	.018	.001	.087	.039	.002	.008	.065	.253	.030	.253
07	.030	.014	.026	.009	.007	.010	.014	.037	.065	.070	.064	.045	.024	.012	.003	.004	.001	.049	.017	.000	.000	.041	.161	.102	.035	.161
08	.076	.126	.173	.132	.059	.075	.075	.084	.040	.018	.019	.017	.000	.001	.001	.019	.056	.086	.115	.050	.084	.179	.077	.003	.065	.179
09	.004	.007	.006	.005	.003	.005	.007	.081	.106	.076	.047	.046	.029	.016	.023	.009	.016	.050	.050	.061	.068	.092	.036	.036	.037	.106
10	.007	.007	.009	.007	.015	.003	.009	.012	.009	.003	.003	.001	.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000	.006	.057
11	.000	.000	.003	.006	.040	.015	.038	.060	.024	.042	.065	.051	.032	.045	.037	.013	.020	.000	.003	.005	.003	.004	.004	.002	.022	.080
12	.002	.002	.001	.002	.002	.003	.013	.007	.001	.004	.007	.007	.002	.003	.003	.004	.001	.000	.027	.000	.000	.003	.011	.010	.005	.027
13	.076	.109	.052	.079	.121	.041	.026	.037	.026	.024		.023	.003	.006	.034	.034	.025	.052	.042	.000	.001	.000	.000	.002	.037	.121
14	.027	.017	.035	.026	.029	.018	.013	.034	.019	.016	.035	.009	.005	.000	.000	.000	.000	.000	.011	.004	.000	.052	.006	.017	.010	.052
15	.008	.004	.001	.035	.171	.153	.103	.120	.094	.050	.015	.002	.022	.016	.007	.007	.001	.001	.007	.004	.004	.000	.001	.015	.035	.171
16	.023	.045	.015	.013	.012	.010	.010	.014					.010	.031	.021	.019	.003	.003	.002	.002	.003	.004	.012	.025	.014	.045
17	.046	.155	.151	.157	.018	.023	.020	.024	.010	.031	.015	.014	.041	.034	.017	.013	.009	.008	.006	.003	.003	.091	.095	.013	.042	.157
18	.016	.009	.009	.023	.006	.013	.020	.019	.032	.043	.029	.016	.004	.024	.027	.005	.004	.004	.018	.014	.008	.014	.017	.008	.016	.043
19	.010	.005	.004	.006	.007	.006	.021	.031	.020	.022	.012	.074	.039	.025	.032	.040	.031	.005	.072	.052	.038	.014	.016	.008	.025	.074
20	.130	.385	.046	.020	.018	.012	.015	.082	.243	.031		.060	.028	.040	.018	.025	.011	.007	.011	.012	.051	.099	.008	.006	.059	.385
21	.008	.006	.021	.018	.011	.013	.022	.010	.018	.032	.037	.031	.007	.004	.004	.011	.023	.024	.007	.003	.004	.004	.005	.012	.016	.087
22	.013	.010	.012	.025	.018	.014	.012	.029	.010	.013	.013	.013	.004	.017	.030	.040	.029	.071	.070	.080	.016	.125	.006	.013	.028	.125
23	.009	.010	.010	.007	.043	.014	.020	.064	.084	.124	.068	.068	.026	.019	.021	.009	.044	.025	.033	.072	.044	.006	.005	.008	.035	.124
24	.012	.015	.009	.008	.008	.010	.017	.061	.081	.058	.038	.033	.043	.035	.012	.027	.023	.027	.004	.002	.001	.015	.053	.037	.026	.081
25	.009	.005	.008	.015	.005	.003	.047	.064				.045	.026	.030	.042	.025	.010	.012	.007	.006	.064	.020	.096	.079	.031	.096
26	.184	.070	.006	.010	.015	.013	.017	.011	.052	.053	.013	.019	.034	.023	.015	.032	.046	.034	.003	.005	.000	.040	.014	.120	.035	.184
27	.202	.015	.011	.011	.011	.011	.034	.029	.030	.019	.009	.012	.033	.056	.101	.071	.036	.005	.008	.011	.017	.005	.006	.009	.032	.202
28	.028	.031	.047	.096	.062	.149	.061	.042	.133	.102	.065	.048	.070	.129	.069	.056	.039	.094	.005	.027	.016	.019	.029	.005	.061	.149
29	.013	.013	.036	.028	.013	.014	.010	.002	.006	.035	.050	.047	.027	.049	.002	.001	.001	.008	.168	.007	.008	.012	.006	.002	.023	.168
30	.004	.009	.013	.030	.018	.018	.032	.146	.088	.071	.067	.025	.016	.004	.003	.032	.046	.023	.011	.010	.012	.010	.021	.035	.031	.146
31	.019	.013	.012	.012	.013	.016	.017	.307	.270	.031	.003	.025	.035	.012	.000	.000	.000	.000	.000	.038	.030	.005	.000	.019	.037	.307
	31	31	31	31	31	31	31	31	29	29	27	30	31	30	31	31	31	31	31	31	31	31	31	31	NO	
	.033	.037	.027	.028	.027	.026	.025	.051	.057	.037	.030	.026	.022	.024	.020	.018	.017	.021	.027	.019	.021	.030	.028	.029	MEAN	
	.202	.385	.171	.157	.171	.153	.103	.307	.270	.124	.087	.074	.070	.129	.101	.071	.056	.094	.168	.080	.088	.179	.161	.253	MAX	

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 18
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NBR READINGS 734
MONTHLY MEAN .028
MONTHLY MAX .385

Figure AP-5-I

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 03/24/83 — PAGE 694

PARAMETER: WIND DIRECTION (61102) UNITS: DEGREES (14) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: INSTRUMENTAL (50) ANALYSIS METHOD: DAS/MANUAL AVERAGE SAMPLING INTERVAL: 01 HOURS

SITE: BILLINGS - COBURN ROAD - MV,MET - SO2 STUDY 9/81 (0060-066) AGENCY: STATE (F)
PROJECT: SPECIAL STUDIES (05) YEAR: 1982 MONTH: MARCH

MONTANA STANDARD:
FEDERAL PRIMARY STANDARD:
FEDERAL SECONDARY STANDARD:

DAY	HOUR																								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG MAX
01											135	65	100	50	75	40	360	20	40	40	40	50	55	55	83 360
02	60	60	50	50	60	60	65	60	60	35	20	50	45	40	45	50	35	25	360	360	100	10	40	345	87 360
03	5	25	50	70	130	55	95	115	150	300	50	25	20	60	35	10	15	30	20	50	45	50	55	45	69 300
04	50	45	45	55	60	50	55	50	40	50	45	40	55	55	60	65	47	75	52	50	58	65	59	345	67 348
05	345	18	55	64	204	235	235	229	234	240	237	241	241	240	243	245	255	249	242	239	236	245	261	313	223 348
06	212	13	12	46	34	82	114	155	130	132	123	124	129	134	144	183	182	202	13	49	34	33	119	138	106 212
07	303	95	121	134	223	209	240	250	240	242	231	247	277	303	307	350	326	307	284	270	239	232	253	26	238 350
08	49	43	71	71	76	52	47	42	45	107	133	119	143	139	100	139	160	190	220	224	229	222	188	154	124 229
09	225	224	240	241	239	241	240	243	241	244	247	247	257	256	255	265	270	265	255	250	247	250	245	248	245 270
10	246	248	245	244	251	293	345	326	248	330	355	349	341	210	135	145	140	155	155	188	150	116	32	114	223 355
11	201	202	226	217	227	231	161	241	235	226	256	252	221	203	217	189	197	221	217	206	216	300	292	297	227 300
12	297	289	279	280	282	283	281	272	281	281	272	270	276	279	265	274	279	278	281	259	254	240	271	239	271 297
13	239	227	225	221	224	232	232	242	242	245	237	258	254	259	237	232	249	173	150	169	272	321	150	244	230 321
14	225	235	240	234	232	233	240	239	239	237	233	242	235	352	348	51	21	26	44	61	113	21	2	64	173 352
15	105	140	25	231	235	238	209	225	243	258	326	37	34	41	25	296	317	347	9	356	356	3	79	16	175 356
16	302	266	216	214	248	247	227	246	229	224	133	99	74	74	86	109	98	98	72	53	51	49	57	42	147 302
17	41	41	36	36	9	12	19	29	37	49	51	57	50	50	69	65	95	94	109	129	81	77	79	72	58 129
18	76	66	61	85	89	72	76	77	88	81	92	79	75	64	60	41	35	35	34	36	36	36	30	34	59 89
19	35	20	24	356	343	338	315	323	345	343	348	348	335	326	337	348	345	335	347	337	327	345	341	306	299 356
20	321	310	303	297	271	271	251	249	237	243	217	220	220	255	207	190	200	195	195	205	214	218	234	236	240 321
21	236	239	230	239	239	244	235	235	234	242	237	234	230	225	220	225	226	223	232	229	223	225	233	232	232 244
22	235	238	238	236	237	236	239	230	230	230	230	230	230	231	234	232	225	218	225	240	237	246	232	222	232 246
23	249	243	241	248	260	270	275	265	287	283	282		260	250	289	309	340	1	22	41	53	53	44	45	203 340
24	70	33	29	54	51	343	332	239	260	269	287	19	16	7	8	4	13	49	199	195	210	230	240	214	140 343
25	215	209	235	241	237	209	197	219	235	150	90	60	65	40	73	39	13	36	77	78	56	20	305	15	130 305
26	35	55	160	230	270	250	258	245	255	355	60	65	55	60	80	110	140	145	135	215	185	230	215	270	174 355
27	221	235	232	225	225	230	237	220	239	230	221	217	215	20	70	10	40	90	125	170	128	217	316	139	181 316
28	33	314	211	290	259	290	280	5	330	10	300	30	35	75	40	340	333	325	324	349	139	210	235	195	206 349
29	250	228	207	251	236	273	228	241	230																246 286
30				255	262	251	257	241	257	254	274	269	264	257	275	279	263	292	287	272	251	225	235	225	265 292
31	200	41	139	79	209	140	120	60	57	41	31	19	27	201	174	155	143	153	153	159	179	205	190	155	148 296
	29	28	29	30	30	30	30	30	30	29	30	29	30	30	30	30	30	30	30	30	30	30	30	30	NO
	177	161	157	184	184	206	204	178	204	184	181	156	170	161	157	166	178	162	161	153	165	158	165	169	MEAN
	345	313	303	356	343	343	345	323	345	343	348	348	335	352	348	348	345	347	360	360	356	345	341	345	MAX

MONTANA STANDARD VALUE: 0
FEDERAL PRIMARY STANDARD VALUE: 0
FEDERAL SECONDARY STANDARD VALUE: 0

TOTAL SAMPLE READINGS 715
MONTHLY MEAN 177
MONTHLY MAX 360

Figure AP-6-I

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 03/24/83 — PAGE 592

PARAMETER: *IND SPEED (61101) UNITS: METERS PER SECOND (11) MIN DET: .3 DECIMAL CODE: 1
COLLECTION METHOD: INSTRUMENTAL (50) ANALYSIS METHOD: DAS/MANUAL AVERAGE SAMPLING INTERVAL: 01 HOURS

SITE: BILLINGS - LOCKWOOD CO PARK - HV.MET - SO2 STUDY 9/81 (0080-065) AGENCY: STATE
PROJECT: SPECIAL STUDIES (05) (F)
YEAR: 1962 MONTH: MAY

MONTANA STANDARD:
FEDERAL PRIMARY STANDARD:
FEDERAL SECONDARY STANDARD:

DAY	HOUR																								AVG	MAX
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
01	1.4	1.0	.7	1.6	1.1	1.8	2.5	3.1	2.7	1.9	1.6	1.5	2.0	1.6	1.6	1.9	1.7	1.7	2.0	1.6	1.9	3.3	2.6	1.7	2.0	3.3
02	.8	1.2	1.1	1.4	1.1	2.2	2.1	1.7	1.5	2.3	1.2	1.2	1.4	2.0	3.0	2.7	3.2	1.8	1.7	2.2	3.1	2.7	2.1	1.6	1.9	3.2
03	2.1	1.6	1.3	1.3	1.3	.9	1.1	1.6	1.2	1.2	1.3	1.5	3.1	3.7	5.0	5.3									2.1	5.3
04					2.2	2.9	6.0	6.5	6.6	7.0	7.6	8.6	8.8	8.8	8.8	6.9	7.3	7.4	5.3	4.9	3.9	2.9	2.7	2.3	5.7	8.8
05	2.7	1.5	1.5	1.8	1.9	2.9	4.8	6.7	8.4	7.4	6.2	5.0	4.8	5.2	4.3		6.0	5.2	4.0	3.3	1.9	1.8	1.5	1.9	3.9	8.4
06	2.2	1.4	2.5	2.9	2.3	2.1	4.5	6.6	6.7	5.3	5.3	5.4	5.2	5.1	5.9	7.2	6.6	7.8	6.0	5.7	4.3	3.9	2.3	2.2	4.6	7.8
07	2.0	1.3	1.1	1.1	1.1	.7	1.8	2.9	2.9	3.5	5.1	5.0	5.2	5.4	5.1	3.8	6.6	1.7	1.4	1.2	4.1	2.3	1.6	1.9	2.9	6.6
08	1.4	1.5	1.3	1.3	2.4	2.0	2.5	1.9	1.8	2.0	4.4	5.2	5.4	5.3	5.0	4.9	4.3	4.1	4.3	5.0	4.6	4.6	4.7	3.6	3.6	5.4
09	3.3	3.1	3.1	3.3	3.3	3.4	3.3	3.4	3.6	3.5	3.5	3.2	2.9	3.0	3.8	3.7	4.0	3.1	3.0	2.9	1.4	1.9	1.5	1.5	3.0	4.0
10	1.7	1.1	1.1	1.2	.8	1.7	1.0	1.2	2.1	1.6	3.3	3.6	4.4	5.0	5.1	5.5	4.7	4.0	3.3	2.6	2.1	1.7	1.4	1.1	2.6	5.5
11	1.2	1.0	.7	.8	.7	.7	1.4	2.5	2.2	2.2	2.1	1.7	2.1	2.8	3.0	2.5	1.9	2.6	1.0	1.2	.8	.8	.8	1.4	1.6	3.0
12	.9	1.0	.6	.9	.8	1.5	1.6	1.7	3.1	4.8	4.9	3.4	3.7	3.8	3.4	4.0	3.3	2.8	1.4	1.6	1.4	1.0	1.2	.9	2.2	4.9
13	1.2	1.4	1.6	1.7	2.3	2.2	1.9	2.0	3.2	3.5	3.4	3.4	2.9	4.5	4.6	4.0	3.9	3.7	2.0	.8	.5	1.5	1.2	1.0	2.4	4.6
14	1.1	1.5	1.6	1.7	2.1	1.6	2.5	2.6	1.9	1.2	1.6	2.2	2.8	2.0	3.8	4.1	1.8	1.2	2.7	4.6	3.1	3.4	2.9	2.7	2.4	4.6
15	1.2	.9	.9	.7	.9	1.3	1.5	1.9	2.1	1.7	1.5	2.1	2.3	3.0	2.1	1.8	2.5	3.1	2.4	1.6	2.2	1.0	.7	.5	1.7	3.1
16	.5	.4	.3	.8	.9	.9	.6	.7	1.4	1.4	1.5	2.1	2.7	3.2	2.8	3.1	3.1	3.0	3.2	1.5	.7	1.0	.8	.7	1.6	3.2
17	.7	.8	.9	.9	.9	.9	1.7	2.4	2.7	3.7	2.3	1.3	1.5	2.2	1.7	1.9	2.3	2.6	2.9	1.4	1.7	2.5	1.6	1.7	1.8	3.7
18	2.2	2.2	1.3	1.0	.6	.9	.8	1.1	1.1	1.2	1.9	2.8	2.6	2.7	2.7	3.2	3.0	2.2	6.6	6.9	3.4	1.7	1.4	1.3	2.3	6.9
19	1.0	1.4	1.9	2.1	2.5	1.9	2.1	3.0	3.1	3.9	3.6	3.4	3.4	2.2	1.9	1.4	1.3	.9	1.0	1.7	1.5	.9	1.5	1.7	2.1	3.9
20	1.6	2.5	2.5	1.7	1.9	1.9	2.0	1.6	2.1	3.0	3.7	3.8	3.5	2.9	2.9	2.7	2.8	4.0	2.5	1.8	2.0	1.7	1.0	1.3	2.4	4.0
21	1.2	.9	.9	1.0	.9	.9	2.3	3.3	3.7	3.6	3.7	2.2	2.6	2.4	1.8	2.1	2.1	1.9	2.5	2.0	1.9	1.8	1.4	1.7	2.1	3.7
22	2.5	1.4	.7	.6	1.0	.5	1.2	1.6	.9	1.0	1.6	2.2	2.5	2.5	2.8	2.9	2.3	4.0	6.6	3.2	2.2	2.4	1.6	1.0	2.1	6.6
23	1.4	2.0	3.3	2.5	2.4	3.0	3.0	2.7	4.6	5.7	6.1	6.4	6.0	6.6	6.7	2.6	1.6	1.8	1.9	1.7	1.8	2.4	1.4	1.8	3.5	8.8
24	2.3	2.4	2.6	3.4	2.3	3.6	4.0	4.1	5.1	6.4	5.3	5.3	5.3	4.4	4.6	4.3	5.3	4.2	3.2	1.2	1.0	.7	.8	.6	3.5	6.4
25	1.0	.7	.9	.7	1.3	1.4	2.1	2.1	1.5	1.1	2.2	2.3	2.7	2.1	2.3	1.8	3.1	3.9	3.0	2.0	1.9	2.4	2.3	1.4	1.9	3.9
26	.9	.8	.7	.8	.3	1.4	.3	3.5	4.1	3.7	4.2	4.4	4.7	4.7	5.1	5.0	4.8	5.5	8.0	4.7	2.3	1.9	1.2	.8	3.1	8.0
27	.9	2.4	4.2	2.9	3.4	3.5	3.4	4.7	4.8	3.5	3.5	3.7	4.7	5.2	4.8	4.2	3.7	4.5	3.2	2.4	3.8	4.5	3.9	2.0	3.7	5.2
28	2.8	1.9	1.6	3.8	4.1	3.5	3.7	4.1	4.2	3.2	3.8	5.3	5.3	8.3	9.8	8.2	6.4	6.8	9.5	6.7	6.7	5.9	4.7	5.3	5.4	9.8
29	5.5	5.2	7.0	5.7	5.9	5.5	6.5	9.9	10.3	10.8	10.8	11.0	9.5	10.0	9.6	9.3	8.0	8.1	5.8	4.1	4.2	3.4	2.8	2.4	7.1	11.0
30	1.2	1.2	2.3	1.3	1.4	1.3	2.8	3.8	4.5	4.9	6.2	5.7	6.9	7.3	6.1	5.1	4.7	4.8	4.0	1.1	1.2	1.5	1.2	1.2	3.4	7.3
31	1.2	.9	1.2	1.3	1.3	.8	2.1	2.3	1.6	1.5	1.5	1.9	2.4	2.1	2.7	3.4	3.3	3.1	2.5	1.4	2.3	2.7	3.9	3.5	2.1	3.9
	30	30	30	30	30	31	31	31	31	31	31	31	31	31	31	30	30	30	30	30	30	30	30	30	NO	
	1.7	1.6	1.7	1.8	1.8	1.9	2.4	3.1	3.4	3.5	3.7	3.7	4.0	4.3	4.3	4.0	3.9	3.8	3.6	2.8	2.5	2.4	2.0	1.8	MEAN	
	5.5	5.2	7.0	5.7	5.9	5.5	6.5	9.9	10.3	10.8	10.8	11.0	9.5	10.0	9.8	9.3	8.4	8.8	8.5	6.9	6.7	5.9	4.7	5.3	MAX	

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NBR READINGS 730
MONTHLY MEAN 2.9
MONTHLY MAX 11.0

Figure AP-7-1

FREQUENCY SUMMARY OF UPPER LEVEL WINDS (PERCENTAGES)

LOCATION: FLATHEAD CO - AIRPORT - FLATHEAD STUDY MET

100 METER LEVEL WINDS MORNING JUNE, 1982

DIRECTION	********* WIND SPEEDS METERS/SECOND *********						ROW	SUMMARY	
	00.1 TO 02.9	03.0 TO 05.9	06.0 TO 09.9	10.0 TO 15.9	16.0 TO 25.0	GREATER THAN 25.0	TOTAL COUNT	TOTAL PERCENT	AVERAGE SPEED
N	10.0						1	10.0	.7
NNE	10.0	30.0	20.0				6	60.0	4.8
NE	10.0	10.0					2	20.0	2.4
ENE							0	0.0	
E							0	0.0	
ESE							0	0.0	
SE							0	0.0	
SSE							0	0.0	
S							0	0.0	
SSW							0	0.0	
SW							0	0.0	
WSW							0	0.0	
W							0	0.0	
WNW							0	0.0	
NW							0	0.0	
NNW		10.0					1	10.0	5.8
CALM							0	0.0	
COL. TOTALS	30.0	50.0	20.0				10		4.0

100 METER LEVEL WINDS AFTERNOON JUNE, 1982

DIRECTION	********* WIND SPEEDS METERS/SECOND *********						ROW	SUMMARY	
	00.1 TO 02.9	03.0 TO 05.9	06.0 TO 09.9	10.0 TO 15.9	16.0 TO 25.0	GREATER THAN 25.0	TOTAL COUNT	TOTAL PERCENT	AVERAGE SPEED
N	8.3						1	8.3	2.3
NNE							0	0.0	
NE			8.3				1	8.3	7.9
ENE							0	0.0	
E							0	0.0	
ESE	8.3						1	8.3	1.9
SE							0	0.0	
SSE	16.6	16.6					4	33.2	3.6
S		8.3	8.3				2	16.6	5.6
SSW	8.3						1	8.3	1.3
SW	8.3						1	8.3	2.3
WSW							0	0.0	
W							0	0.0	
WNW							0	0.0	
NW							0	0.0	
NNW	8.3						1	8.3	2.3
CALM							0	0.0	
COL. TOTALS	58.1	24.9	16.6				12		3.6

ACCUSTIC RADAR ANALYSIS

RONAN-NINEPIPES (0820-012) MONTH OF APRIL 1982

********* TWO HOUR STABILITY ANALYSIS **********

DAY	HOUR 02	04	06	08	10	12	14	16	18	20	22	24
1	E	E	E	E	D	C	C	C	E	E	F	F
2	F	E	E	E	D	C	C	C	E	E	E	D
3	D	E	E	D	D	D	D	E	E	E	E	E
4	E	E	E	E	E	D	D	C	D	E	E	E
5	E	E	E	E	D	C	C	C	E	E	E	E
6	E	E	E	D	C	C	C	C	U	E	E	E
7	E	E	E	E	D	C	C	B	E	D	E	E
8	E	F	F	F	D	C	C	C	E	E	E	E
9	U	U	U	U	U	D	C	C	C	D	F	F
10	E	F	F	E	D	C	C	C	D	E	E	E
11	E	D	D	E	D	D	D	D	D	E	D	D
12	D	D	E	D	D	D	C	C	D	D	E	D
13	E	E	E	E	D	C	C	C	E	D	E	E
14	D	D	D	D	C	C	D	D	E	E	F	F
15	E	E	E	D	D	C	C	C	C	E	E	E
16	E	F	F	E	D	C	C	C	C	E	E	E
17	E	E	D	E	D	C	C	C	D	E	E	D
18	E	E	E	E	D	D	D	D	D	D	E	E
19	F	F	F	D	C	C	C	D	D	D	F	F
20	F	F	F	D	C	C	C	C	C	E	F	F
21	F	F	F	D	C	C	C	C	C	D	F	F
22	F	F	F	E	D	C	C	C	C	F	F	F
23	F	F	F	F	D	C	C	C	C	E	F	F
24	F	E	E	D	C	C	C	C	C	E	E	E
25	E	E	E	D	C	C	C	B	D	F	F	F
26	F	F	F	E	D	C	C	C	D	D	E	E
27	F	F	F	D	C	C	C	C	C	D	E	E
28	E	E	E	E	E	D	D	D	C	E	E	E
29	E	E	E	D	C	C	C	C	C	E	F	F
30	F	E	E	D	B	B	C	C	D	D	E	E

PERCENT FREQUENCY OF OCCURENCE FOR EACH CATEGORY

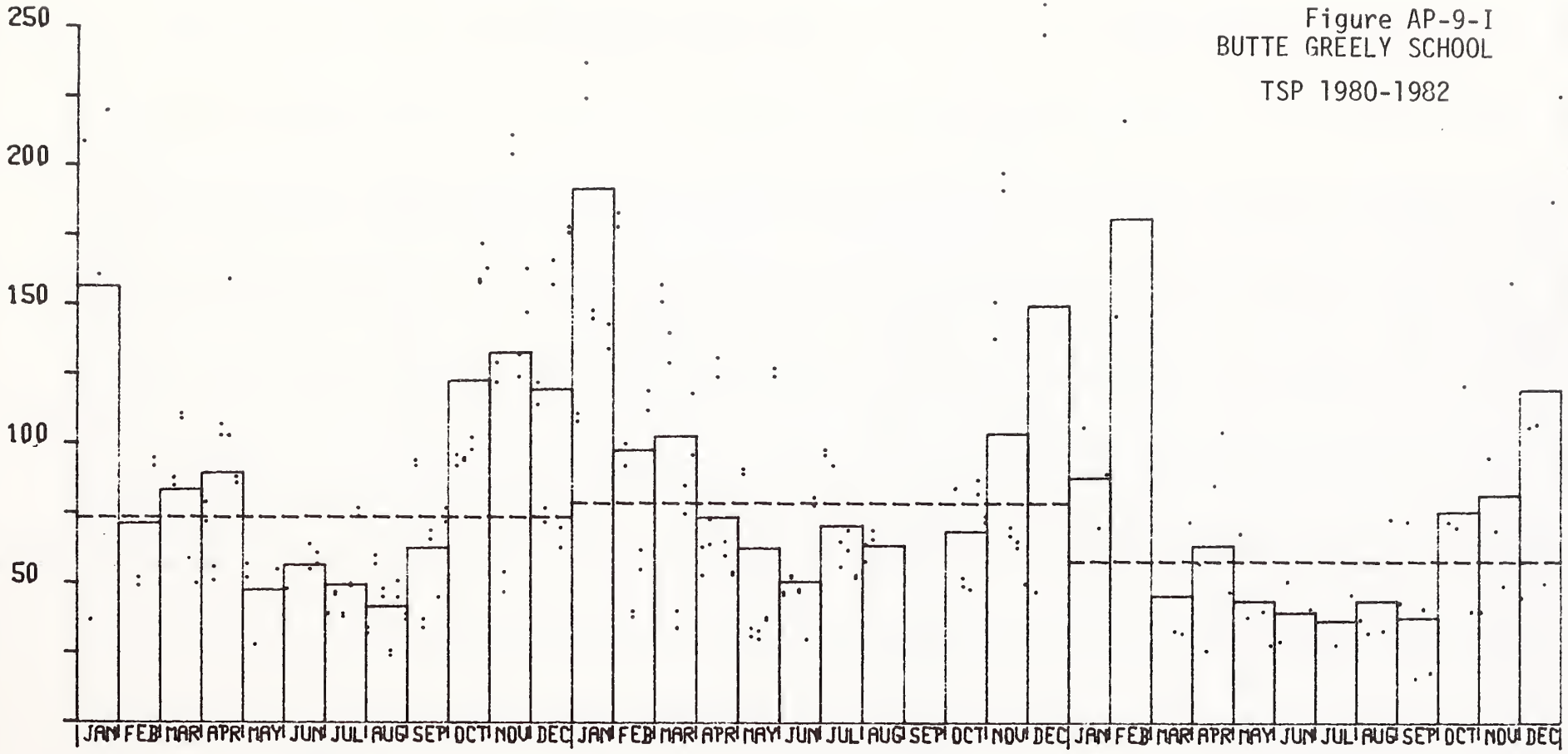
A= 0.0 % B= 1.7 % C=24.2 % D=22.8 % E=34.7 % F=15.0 %

U= 1.7 % M= 0.0 %

NOTE: U=UNKNOWN M=MISSING DATA
CLOUD COVER CONDITIONS USED FROM NWS STATION AT KALISPELL
WIND DATA USED FROM NWS STATION AT KALISPELL

Figure AP-8-I

Figure AP-9-I
BUTTE GREELY SCHOOL
TSP 1980-1982



NUM OBS	4	4	6	10	4	5	10	12	10	10	10	10	10	10	10	10	10	10	9	4		8	10	4	3	2	3	5	4	3	2	4	5	4	5	6
MO.AVG	157	72	84	90	48	57	50	42	63	123	133	120	192	98	103	74	63	51	71	64		69	104	150	88	181	46	64	44	40	37	44	38	76	82	120
GEO.AVG	74												79												58											

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

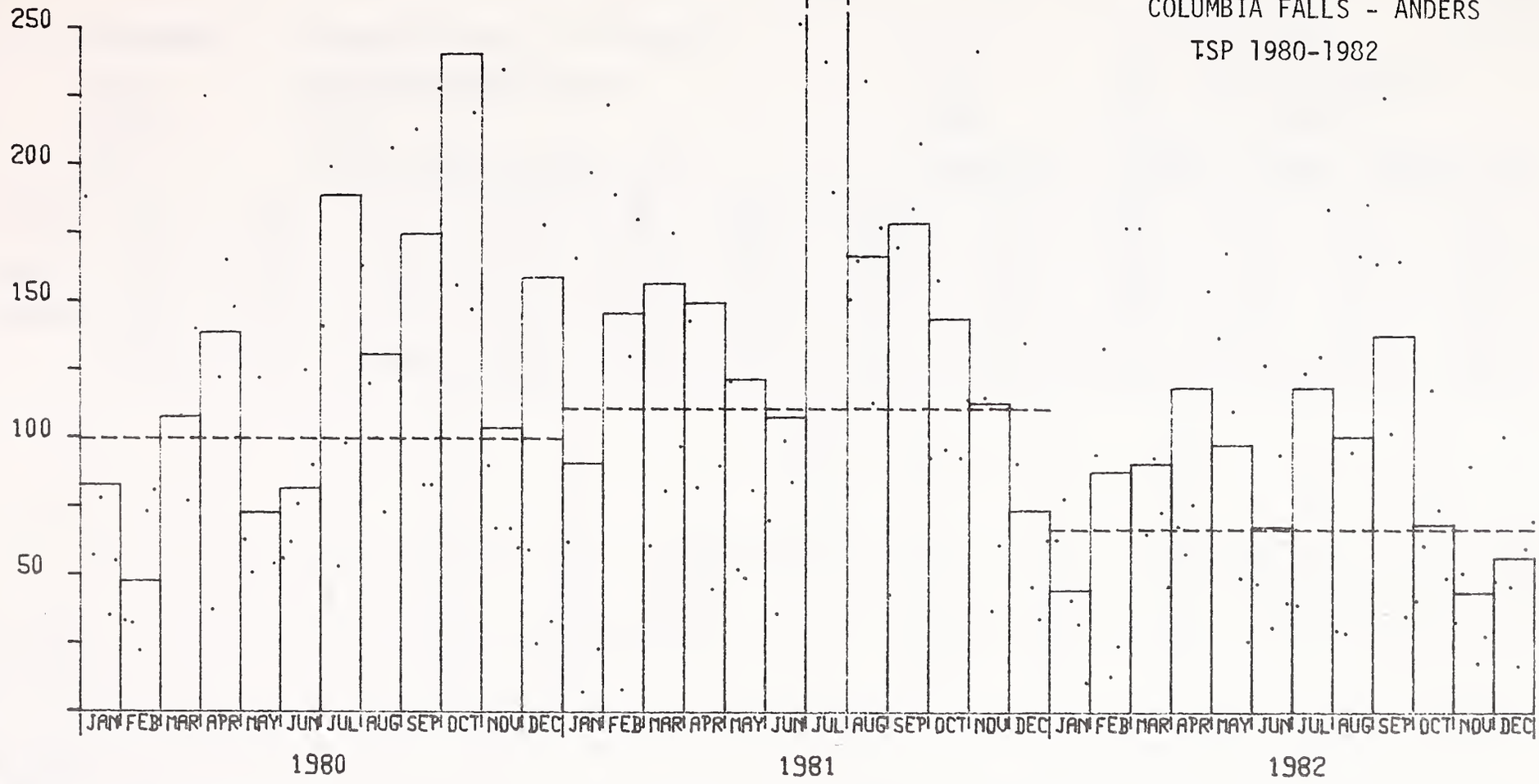
PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0160, SILVER BOW CO
SITE. . . . . 005, GREELEY SCHOOL
CITY. . . . . BUTTE

MONTANA STATE AIR QUALITY BUREAU

APRIL 1983

TECHNICAL SERVICES

Figure AP-10-J
COLUMBIA FALLS - ANDERS
TSP 1980-1982



NUM OBS	5	5	3	5	4	5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	5	5	5	5	5	4	5	5	5	5	6
MO.AUG	83	48	108	139	73	82	189	131	175	241	104	159	91	146	157	150	122	108	319	167	179	144	113	74	45	88	91	119	98	68	119	101	138	69	44	57
GEO.AUG	100												111												67											

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0270, FLATHEAD CO
SITE. . . . . 005, ANDERS RESIDENCE
CITY. . . . . COLUMBIA FALLS

MONTANA STATE AIR QUALITY BUREAU

APRIL 1983

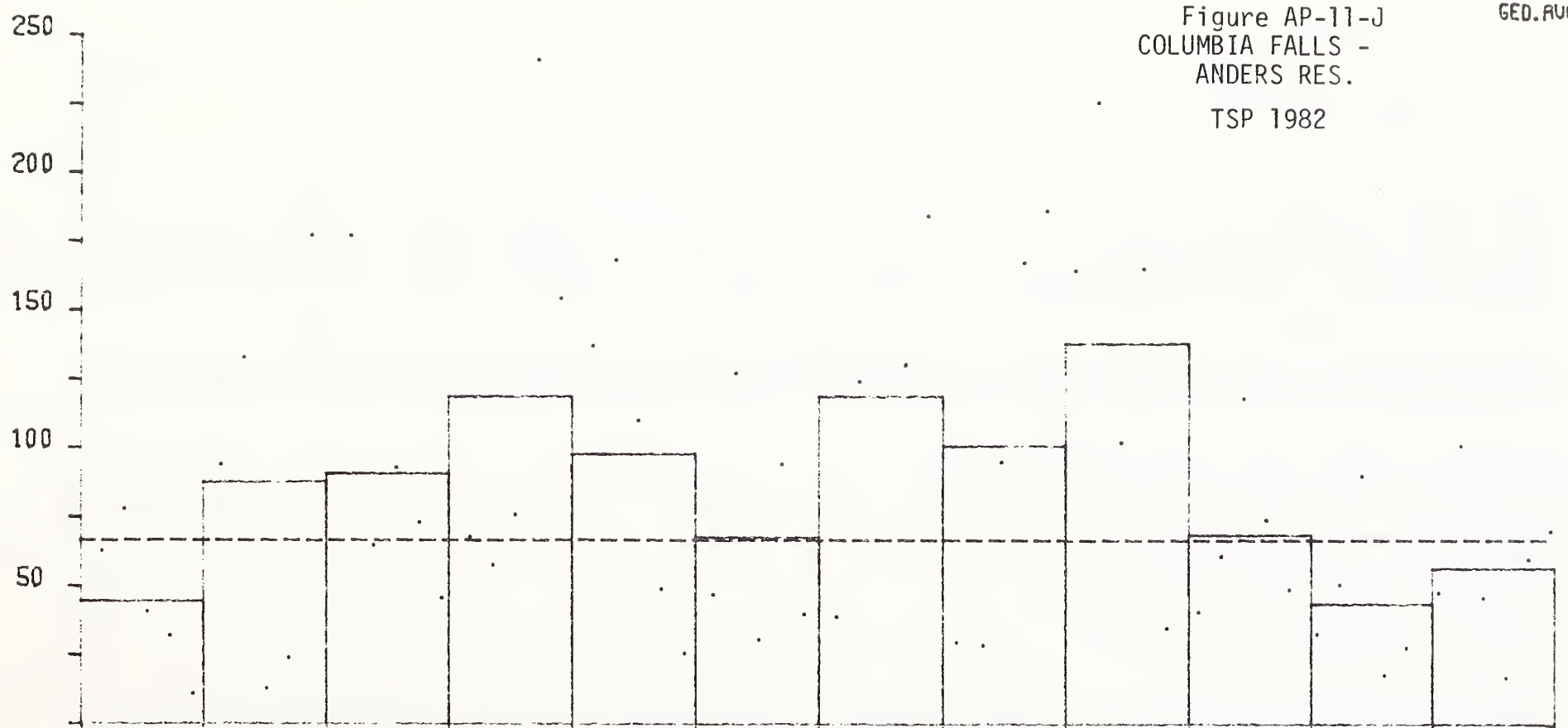
TECHNICAL SERVICES

1982

GED.AUG = 67

Figure AP-11-J
COLUMBIA FALLS -
ANDERS RES.

TSP 1982



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	5	5	5	5	5	5	4	5	5	5	5	6
1-HIGH	78	177	177	241	168	127	184	186	225	118	90	101
2-HIGH	63	133	93	154	137	94	130	167	165	74	51	70
MO.AVG	45	88	91	119	98	68	119	101	138	69	44	57

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0270, FLATHEAD CO
SITE. . . . . 005, ANDERS RESIDENCE
CITY. . . . . COLUMBIA FALLS

MONTANA STATE AIR QUALITY BUREAU

APRIL 1983

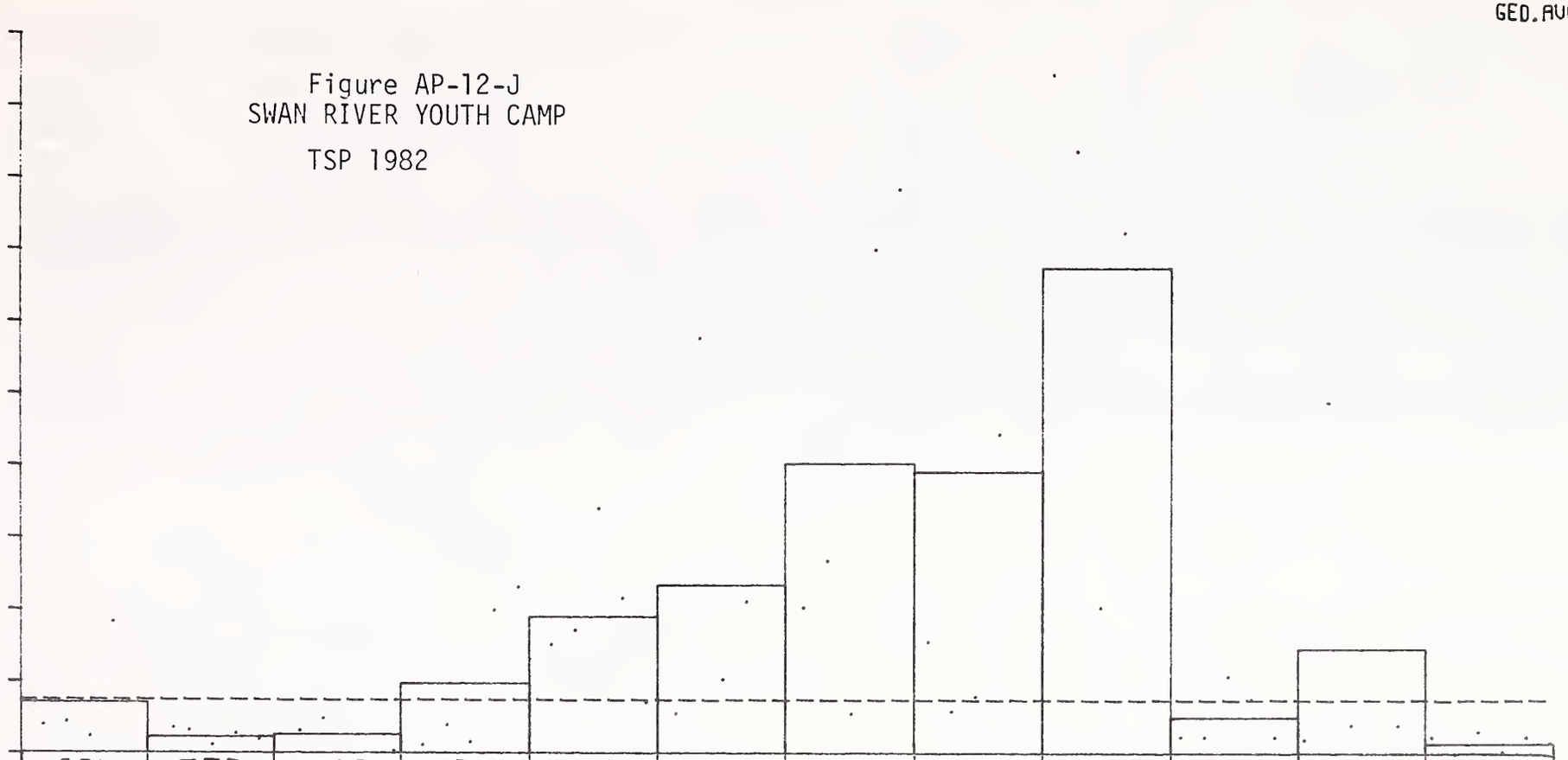
TECHNICAL SERVICES

1982

GED.AVG = 19

Figure AP-12-J
SWAN RIVER YOUTH CAMP

TSP 1982



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	4	5	3	5	5	4	5	5	4	5	4	6
1-HIGH	46	9	12	58	85	144	196	306	236	27	122	8
2-HIGH	11	8	8	50	54	53	175	111	209	19	10	6
MO.AVG	18	6	7	25	48	59	101	98	169	13	37	4

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0820, LAKE CO
SITE. . . . . 017, SWAN RIVER YOUTH CAMP
CITY. . . . . SWAN RIVER

MONTANA STATE AIR QUALITY BUREAU

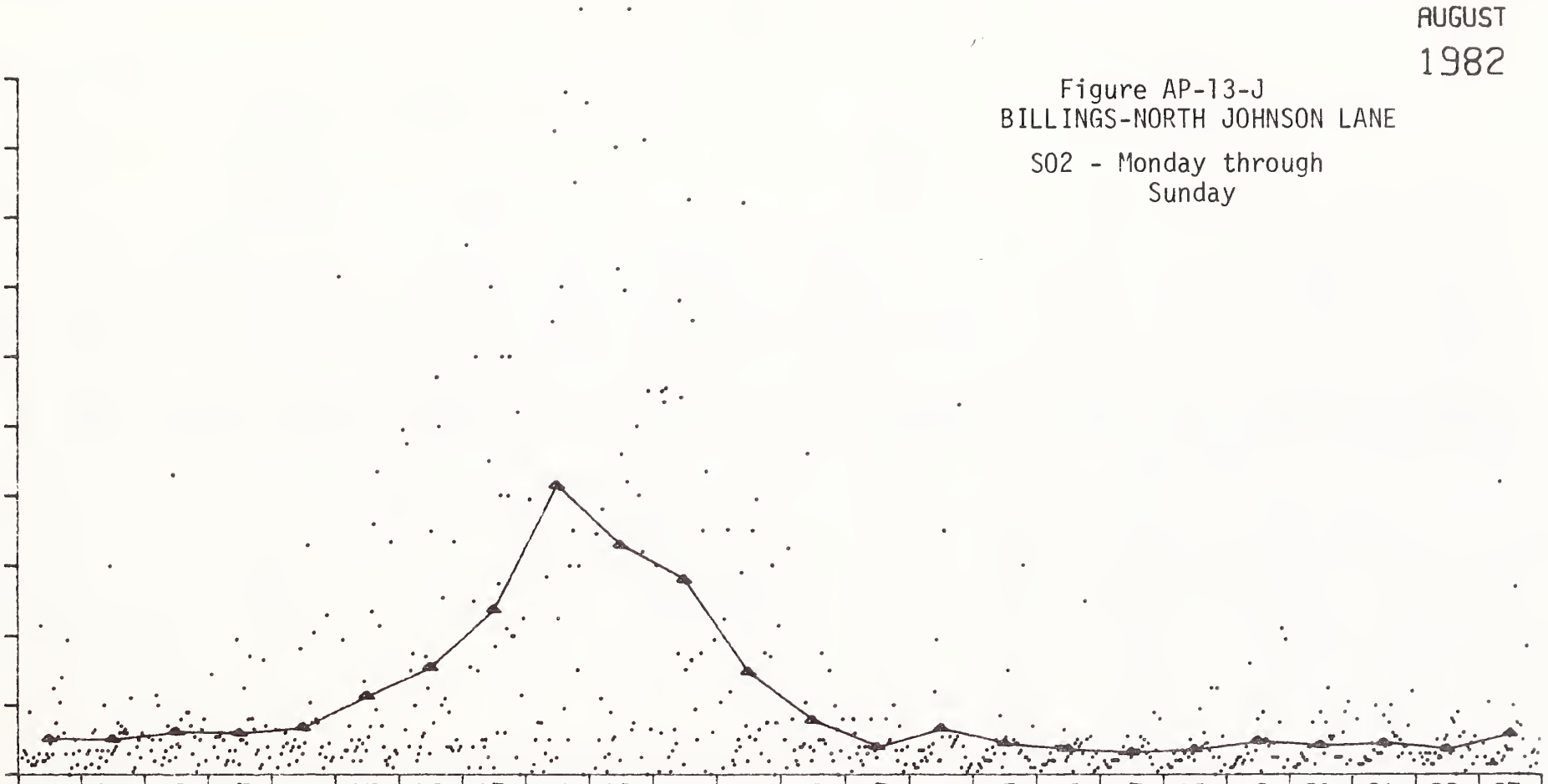
APRIL 1983

TECHNICAL SERVICES

AUGUST
1982

Figure AP-13-J
BILLINGS-NORTH JOHNSON LANE

SO2 - Monday through
Sunday



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
NUM-OBS	31	31	31	31	31	31	31	31	29	29	29	28	27	26	29	29	31	31	31	31	31	31	31	31
1-HIGH	.043	.060	.086	.039	.066	.143	.114	.152	.425	.234	.277	.164	.092	.020	.106	.060	.050	.018	.025	.042	.025	.024	.018	.084
2-HIGH	.039	.022	.023	.034	.046	.087	.100	.140	.250	.220	.165	.079	.065	.016	.070	.030	.013	.016	.025	.039	.021	.020	.016	.054
HR.AVG	.010	.010	.013	.012	.014	.023	.031	.048	.083	.066	.056	.030	.016	.008	.013	.009	.007	.006	.007	.010	.009	.009	.007	.012

PLOT. . . . . CONCENTRATION VERSUS TIME (MON-SUN)
METHOD . . . . . PULSED FLUORESCENT
UNITS . . . . . PARTS PER MILLION
STANDARDS . . . (STATE) .50 PPM 1-HR AVG

PARAMETER . . SULFUR DIOXIDE
AREA. . . . . 0080, YELLOWSTONE CO
SITE. . . . . 064, NORTH JOHNSON LANE
CITY. . . . . BILLINGS

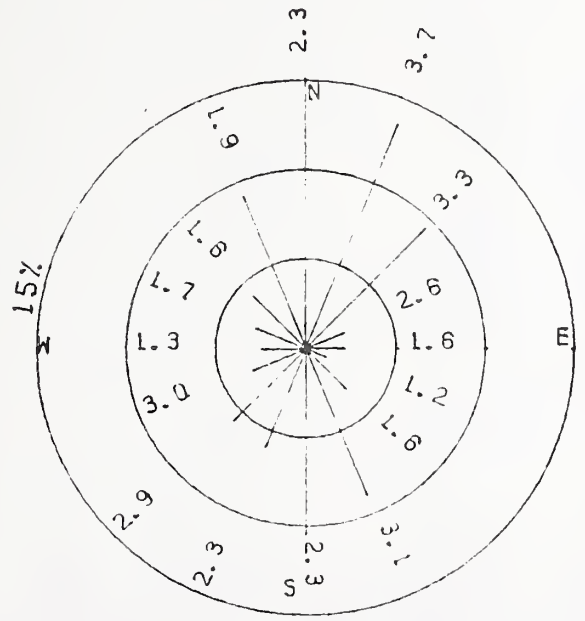
MONTANA STATE AIR QUALITY BUREAU

APRIL 1983

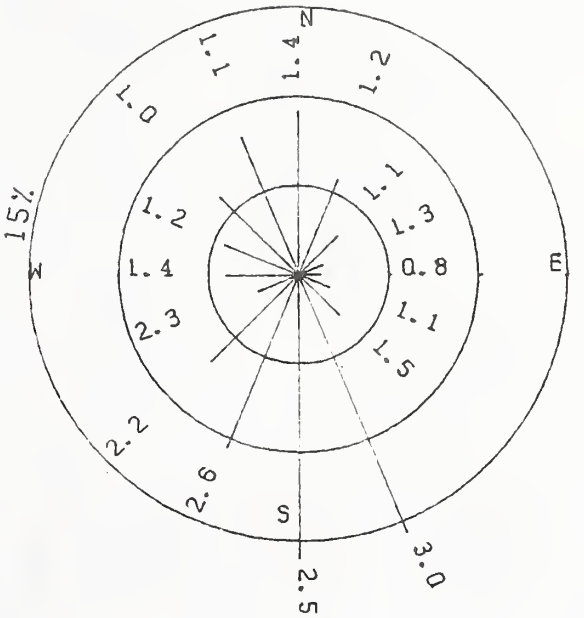
TECHNICAL SERVICES

SITE: 480304 FLATHEAD AIRPORT (GIA)

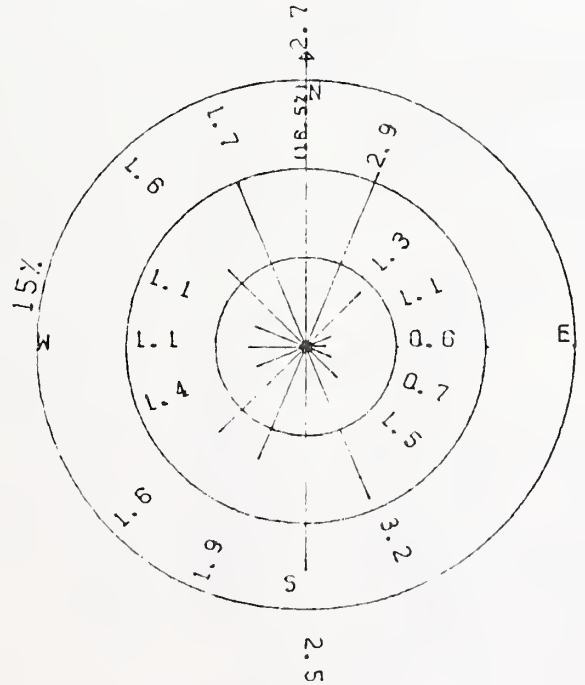
KALISPELL MONTANA



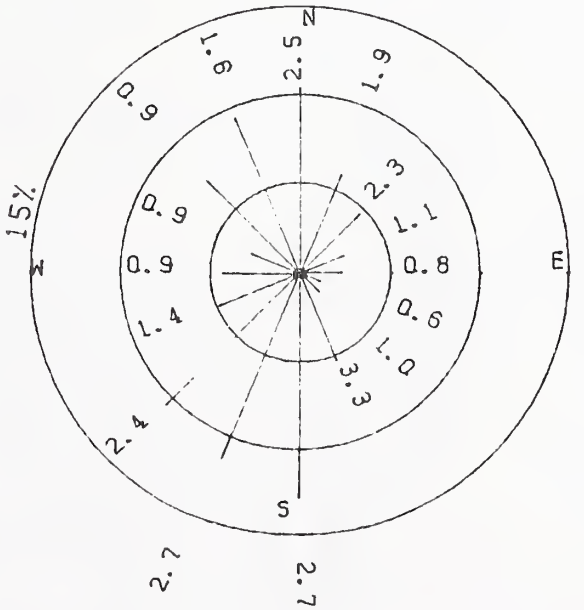
SEPTEMBER 1982
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 720)



OCTOBER 1982
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 744)



NOVEMBER 1982
HOURS 0 TO 23
CALM 1.2%
(TOTAL HOURS 711)



DECEMBER 1982
HOURS 0 TO 23
CALM 3.0%
(TOTAL HOURS 706)

FIGURE
AP-14-I

Figure AP-15-I

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                    STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
                    POINT SOURCE MASTER DETAIL LIST                    REPORT DATE: 07/05/83          PAGE:   359

COUNTY: LINCOLN          0940   AQCR: MISSOULA    144   PLANT ID: 0001

SEGMENT  YEAR OF  LAST     CONTROL  LOCAL     USER                CITY  UTM   OWNER  CONTACT          TELEPHONE    PRINCIPAL   NUMBER OF
  ID     RECORD   UPDATE   REGION   CONTROL   PLANT ID                  ZONE                                         PRODUCT     EMPLOYEES
000        81     11/81                                                  11     P    JIM HURST        4062962712   STUDS          0085

          ESTABLISHMENT NAME AND ADDRESS                ZIP    MAILING ADDRESS                                    ZIP    PROPERTY
                                                                                                                          AREA - ACRES
                                                                                                                          00030.0

**********************************************************************************************************************

SEGMENT  YEAR OF  LAST     POINT ID   SIC    IPP  UTM COORDINATES-KM     LATITUDE     LONGITUDE    % ANNUAL THRUPUT  NORMAL OPERATING
  ID     RECORD   UPDATE   NEDS USER           HORIZ      VERT          DEG MIN SEC  DEG MIN SEC   DEC MAR JUN SEP   HR/D D/WK WK/YR
101        81     04/83     01       2421      642.3     5419.7                                    25  25  25  25    16    5    50

          BOILER     % SPACE    * * * * * * * * * * STACK DATA * * * * * * * * * *    * * COMPLIANCE * *  ECAP CONTROL REGULATION
          CAPACITY    HEAT      HEIGHT  DIAM  TEMP   FLOW RATE   VELOCITY  NBR OF  PLUME HT  STAT  SCHED   STAT          REG1 REG2 REG3
            MM BTU                FEET   FEET  DEG F  CU FT/MIN   FT/MIN    POINTS    FEET            YR MO   DATE
            00000     00.0        0060  25.0   0400     0066423     00135             0000      2                0     1407

          NBR OF  POLLUTANT          CONTROL   CNTL EQUIP  % ESTIM    * * * * * EMISSIONS * * * * *    ESTIM TEST  EMISS
          POLLUTS      ID            COST     PRI  SEC    CONTROL          TONS/YEAR                    METH  METH  UNITS
                                    THOUS $$                EFFICIENCY UNCONTROLLED ESTIMATED ALLOWABLE
            05 SUSPENDED PARTICULATE          000  000      00.0      0000031    0000031                   3
               CARBON MONOXIDE                000  000      00.0      0000573    0000573                   3
               SULFUR  DIOXIDE                000  000      00.0      0000000    0000000                   3
               NITROGEN DIOXIDE               000  000      00.0      0000004    0000004                   3
               VOLATILE ORGANIC COMP          000  000      00.0      0000049    0000049                   3

SEGMENT  YEAR OF  LAST     * * SCC * *  FUEL PROCESS  MAX DESIGN  % SULFUR  % ASH    HEAT CONTENT  CONFID  SOURCE   BEC     FUEL
  ID     RECORD   UPDATE   1  II  III  IV     RATE     RATE-HOURLY  CONTENT  CONTENT    MM BTU      CODE    CODE   NBR ID  UNITS
2 01 05    81     04/83    5  03  001  05   0008821      0008.900     0.00     1.20       00010       2       C

          SOURCE DESCRIPTION          EMIS FACTOR  NBR OF EMIS  POLLUTANT          EMISSION     ASH/SULPHUR  FACTOR
                                        SOURCE      FACTORS        ID              FACTOR          CODE       UNITS
          CONICAL WOOD WASTE BURNER       A           05     SUSPENDED PARTICULATE 000007.000
                                                             CARBON MONOXIDE       000130.000
                                                             SULFUR  DIOXIDE       000000.100
                                                             NITROGEN DIOXIDE      000001.000
                                                             VOLATILE ORGANIC COMP 000011.000

SEGMENT  YEAR OF  LAST     LINE                          * * * * COMMENTS * * * *
  ID     RECORD   UPDATE   NBR
3 01 10    81     04/83    001 EMISSION INVENTORY FOR 197x IS FOR THE                                    (SAME MILL).  THEIR PRODUCTION FOR
```

APPENDIX J

Smoke Management

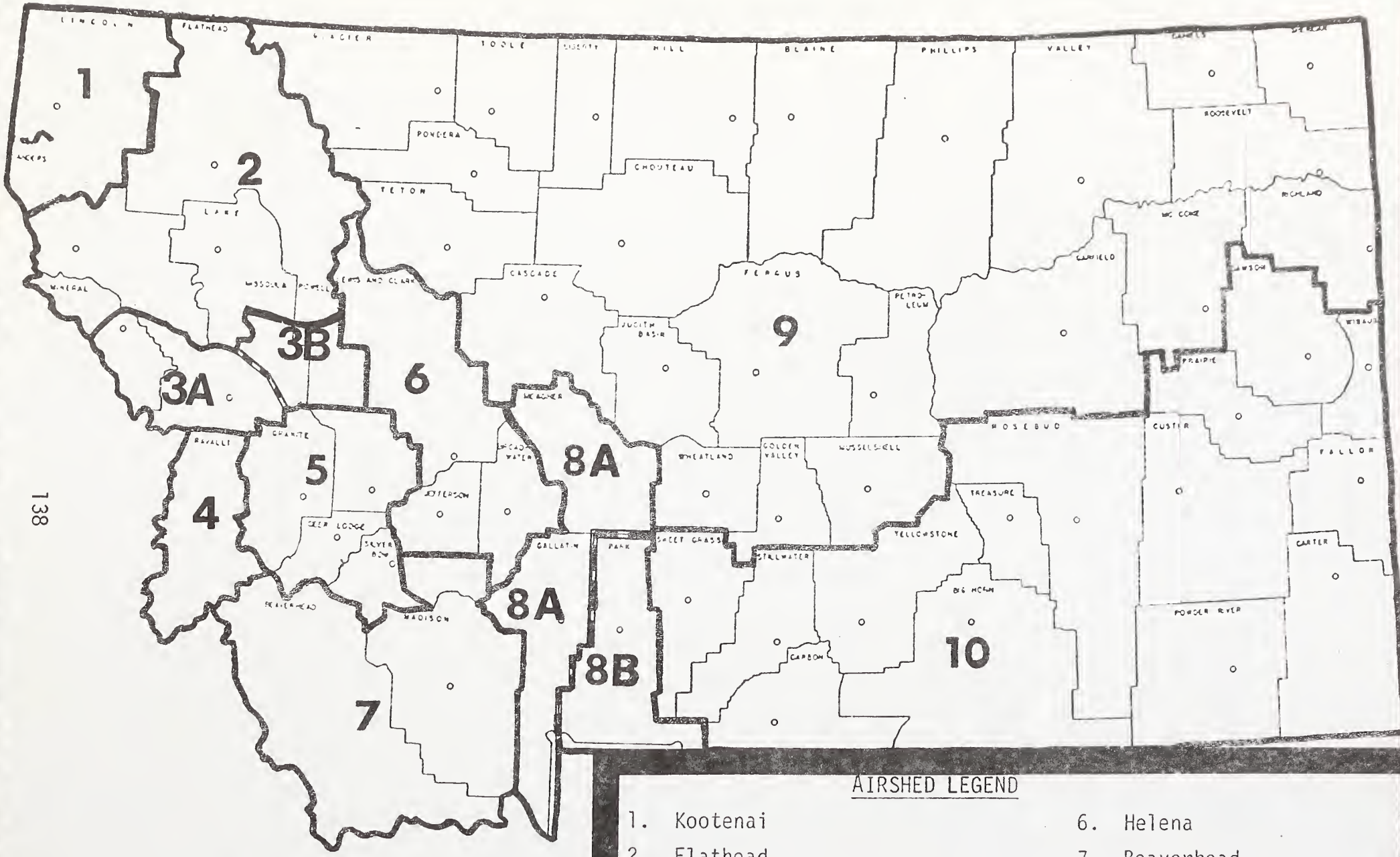
APPENDIX J

SMOKE MANAGEMENT

The Smoke Management Plan was devised by the State Airshed Group to coordinate burning operations on all forest and rangeland in the state. The State Airshed Group consists of representatives from the following agencies and forest products industries.

Air Quality Bureau
U. S. Forest Service
Bureau of Land Management
St. Regis Paper Company
National Weather Service
Glacier National Park
Yellowstone National Park
Missoula City-County Air Pollution Control Board
Bureau of Indian Affairs
Montana Division of Forestry
Burlington Northern, Inc.
Champion International
Mont. Dept. of Fish, Wildlife & Parks
Wicks Forest Industries
U. S. Dept. of Fish and Wildlife

During the autumn months, a two-man monitoring unit is set up at the Montana Division of Forestry Office in Missoula. This unit gathers meteorological information daily and has the authority to issue burning restrictions on days forecast for poor ventilation. Restrictions are issued only for those areas predicted to experience inversions or poor dispersion. Restriction information is available from the U.S. Forest Service Fire Weather network, as well as a state toll-free number available from county sheriffs and sanitarians from September 1 - November 30 each year. The map on the following page (Figure AP-1-J) shows the ten designated airsheds in Montana. The success of this plan involves the cooperative effort of all organizations involved in the use of prescribed burning for disposal of slash and other accepted land management practices.



AIRSHED LEGEND

1. Kootenai
2. Flathead
3. A. Clark Fork B. Blackfoot
4. Bitterroot
5. Upper Clark Fork
6. Helena
7. Beaverhead
8. A. Gallatin B. Park
9. Missouri
10. Yellowstone

Figure AP-1-J

MONTANA SMOKE MANAGEMENT AIRSHEDS

APPENDIX K

Hi-vol Schedules

1983

1983 SAMPLING SCHEDULE
(Every 6th Day)

QUARTER 1

January -	February -	March -
6	5	1
12	11	7
18	17	13
24	23	19
30		25
		31

QUARTER 2

April	May -	June -
6	6	5
12	12	11
18	18	17
24	24	23
30	30	29

QUARTER 3

July -	August -	Sept. -
5	4	3
11	10	9
17	16	15
23	22	21
29	28	27

QUARTER 4

October -	November -	Dec. -
3	2	2
9	8	8
15	14	14
21	20	20
27	26	26

January - (1984)
1
7
13
19
25
31

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

1984

1984 SAMPLING SCHEDULE
(Every 6th Day)

QUARTER 1

January -	February -	March -
1	6	1
7	12	7
13	18	13
19	24	19
25		25
31		31

QUARTER 2

April -	May -	June -
6	6	5
12	12	11
18	18	17
24	24	23
30	30	29

QUARTER 3

July -	August -	September -
5	4	3
11	10	9
17	16	15
23	22	21
29	28	27

QUARTER 4

October -	November -	December -
3	2	2
9	8	8
15	14	14
21	20	20
27	26	26

January - (1985)
1
7
13
19
25
31

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

APPENDIX L

Visible Emission Documentation

APPENDIX L

VISIBLE EMISSION DOCUMENTATION

Visible emission documentation on a pollution source is performed by a trained observer in the field. A pollution source may be a teepee burner, asphalt plant, boiler, power plant or any stack or emission point that might exhibit a plume.

Visible emission readings are taken by the observer in five percent increments of opacity. Opacity is defined as the degree, expressed in percent, to which emissions reduce the transmission of light and obscure the view of an object in the background.

All point sources have opacity limitations. These are listed in the air quality rules. The opacity standards range from 10 to 40 percent and depend on the type and age of the source.

In order for a person to become a trained observer, he or she must attend a visible emissions documentation course or "smoke school." The Air Quality Bureau offers a smoke school twice each year, usually in April and October. The observer must attend a lecture session and pass a field session in order to pass smoke school.

The lecture section includes the following topics:

Definition of opacity

Composition of Plumes

Meteorological aspect of Plumes

Smoke Generator

Method 9 Certification Procedures and Field Documentation

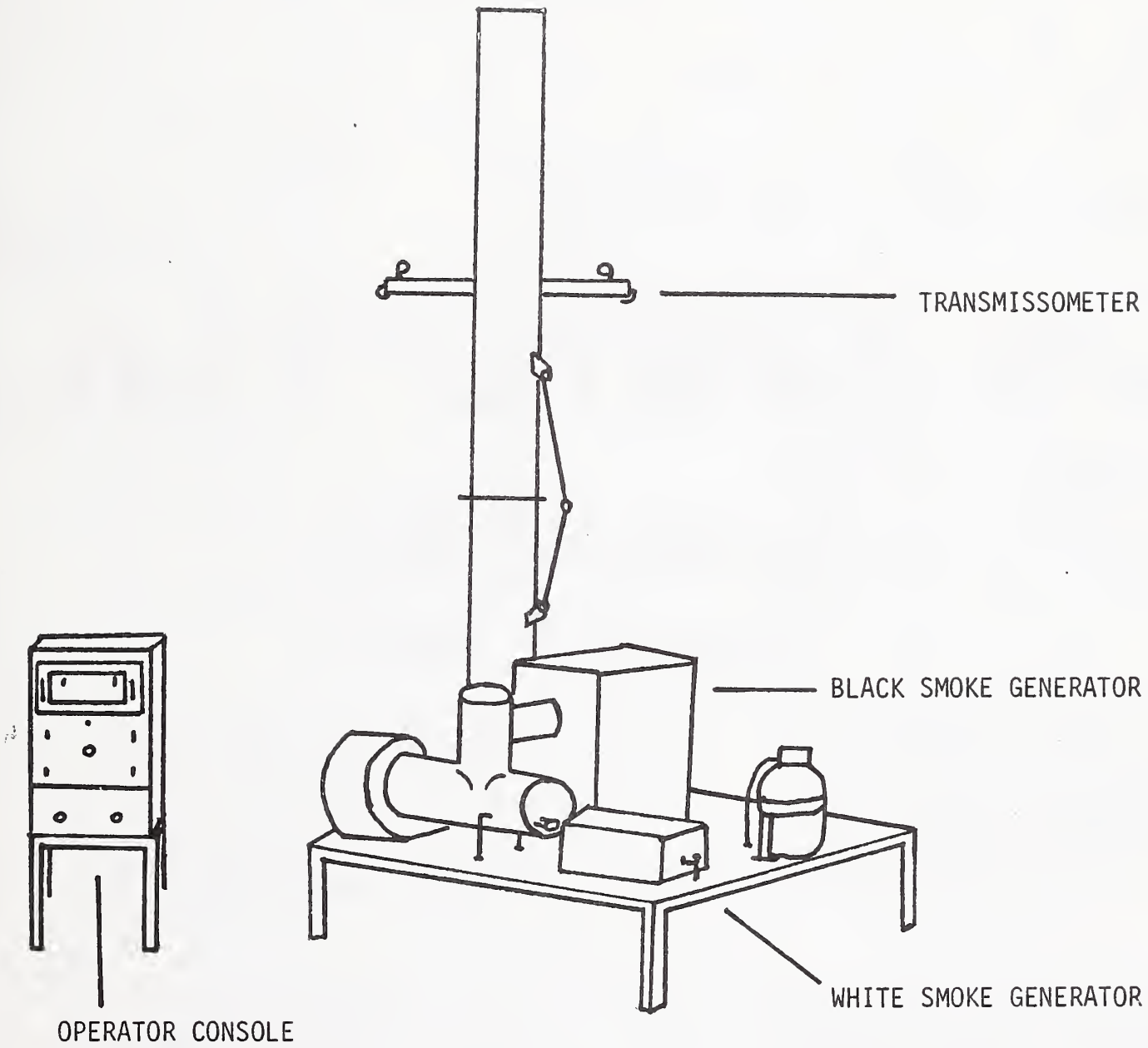
Opacity Regulations

Legal Aspects of Opacity

During the field portion, the observer reads the opacity of 25 black and 25 white smoke plumes produced by a smoke generator. Observed opacities are compared with measured opacities (transmissometer readings) and a certain degree of accuracy is needed to pass.

After a person passes smoke school, that observer is qualified to read the opacity of a plume in the field. A plume must be read every 15 seconds for six minutes, for a total of 24 readings. An average of the 24 readings gives the percent opacity. Care must be taken not to read a steam plume if one exists.

A drawing of the smoke generator (Figure AP-1-N) and a visible emission documentation form (Figure AP-2-N) are copied on the following pages.



ENVIRONMENTAL INDUSTRIES

MODEL 3000

SMOKE GENERATOR

Figure AP-1-N

MONTANA STATE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

VISIBLE EMISSIONS FIELD DOCUMENTATION

FIRM NAME _____ DATE _____
ADDRESS _____ START TIME _____
BUSINESS _____ STOP TIME _____
DESCRIPTION OF SOURCE _____ OBSERVER _____
_____ OBSERVATION POINT _____
TYPE OF FUEL _____ _____
STACK HEIGHT _____ STACK DIAMETER _____ _____
DISTANCE FROM STACK _____ ☐ RESPONSE TO COMPLAINT
DIRECTION FROM STACK _____ ☐ ROUTINE INSPECTION
GENERAL PLUME CHARACTERISTICS (COLOR, ETC.) ☐ OBSERVATION
_____ ☐ SPECIAL INVESTIGATION
GENERAL METEOROLOGY: SKY CONDITIONS AND COLOR _____ EST. AMBIENT
AIR TEMP. _____ EST. WIND SPEED _____ DIRECTION _____ EST. RELATIVE HUMIDITY _____

PLUME DENSITY READINGS: IN OPACITY

MIN \ SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

MIN \ SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

OTHER REMARKS _____

AVERAGE PLUME DENSITY OPACITY _____ TOTAL MINUTES IN VIOLATION _____

IF VIOLATION NOTED, PERSON CONTACTED _____ DATE _____ TIME _____

Figure AP-2-N

VISIBLE EMISSION DOCUMENTATION FORM

APPENDIX M

Air Quality Personnel

APPENDIX M

AIR QUALITY PERSONNEL
1982

Air Quality Bureau

(406)449-3454
(406)248-3266 (Billings)

Harold Robbins, Chief
Dean Arthun (Billings)
John Coefield
Patricia Davidson
Pat Driscoll
Charles Homer
Jim Hughes (Billings)
Harry Keltz
David Maughan
Jackley Meyers
Warren Norton
Jim Olsen
Jerry Preszler
Bob Raisch
Jerry Schneider
Stan Sternbery
Maureen Stohl
Cynthia Wevers

Cascade County Air Pollution Control

(406)761-1190

William Neilsen
Bruce Treis

Missoula City-County Health Department

(406)721-5700

Linda Hedstrom
Bob Jeffreys
Jim Carlson
Scott Church

Yellowstone County Air Pollution Control

(406)252-0756

Steve Duganz
Russ Boschee

APPENDIX N

Air Monitoring Equipment

APPENDIX N

Air Monitoring Equipment

This appendix is intended to give the data and information user a brief description of how air monitoring equipment works. Most of the information contained in this appendix was taken from the Air Quality Bureau's Quality Assurance Handbook.

Table AP-N-I gives a summary of the various pollutants and their analytical procedure.

Table AP-N-I

Pollutants and Analytical Procedures

Analyte	Procedure
Total Suspended Particulate	Filter Impaction/Gravimetric Analysis
Respirable Particulates	Operation/Dichotomous or Virtual Sampler
Particulates	Beta Attenuation
Carbon Monoxide	Non-dispersive Infrared
Lead	Atomic Absorption Spectrophotometry/ICAP
Hydrogen sulfide and sulfur dioxide	Gas chromatography and flame photometric detection
Sulfur Dioxide	Pulsed fluorescence
Nitrogen oxides	Chemiluminescence
Ozone	Ultraviolet photometry
Gaseous and particulate fluorides	Bicarbonate tube
Fluoride	Dual tape sampler
Foliar Fluoride	Colorimetric Method
Visibility	Integrating Nephelometer

Analyte: Total Suspended Particulates (TSP)

Procedure: Filter impaction/gravimetric analysis

General Information:

Particulate matter is collected by a high volume sampler (hi-vol) by pulling a known volume of air through a preweighed glass fiber filter. As the air is pulled through the filter, particulate matter that is suspended in the air is impacted onto the filter material. After the sampler has run for 24 hours, the filter is reweighed (usually in a laboratory). The weight of the particulate matter (grams) on the filter is divided by the volume of air (cubic meters (m^3)) to give a concentration in micrograms per cubic meter (ug/m^3).

The hi-vol is constructed of aluminum in the shape of a box (dimensions 16" x 16" x 48") with a pitched roof. The interior contains a "vacuum cleaner" type electric motor, a filter holder, a flow measuring device(s), and a timer. The samplers usually run on a one-in-six day schedule but may be run more frequently if necessary.

A laboratory type balance is used to weigh the filter. The balance needs to be accurate to one tenth of a milligram (0.1 mg) or one ten thousandth of a gram. There are 453.6 grams in a pound.

Analyte: Particulates

Procedures: Beta attenuation

General Information:

This analyzer measures concentrations of airborne particulates, integrated over preprogrammed time intervals, by the process of beta ray attenuation. Samples are collected on strips of glass fiber tape. Before the sample is collected, the tape is positioned between a beta ray source (C^{14}) and a geiger counter. The beta ray count taken through the tape is used as a blank value. Sample is deposited on the tape by a constant flow of ambient air. The sample and tape are again situated between the source and counter. This second count will be lower than the first count because the sample will absorb some of the beta rays in excess to the amount of x-rays absorbed by the tape itself. The difference in beta ray counts between the tape and the tape plus sample is log proportional to the amount of sample on the tape. After calculating, the sample mass, it is divided by the total airflow over the sample collection period. This gives an integrated particulate concentration for that sample period. All calculations are done internally by the analyzer with a microprocessor. Sample times as low as 3 minutes or as great as 999 minutes can be programmed by the user.

Analyte: Respirable and Inhalable Particulates

Procedure: Operation, Dichotomous or Virtual Impactor

General Information:

The dichotmous sampler is designed to sample for particulates of two size ranges: 1) those particles less than 2.5 microns (aerodynamic diameter), and 2) those particles greater than 2.5 microns and less than 15 microns. Two 37 millimeter diameter filters collect the particulate, one filter for each size range. The filters are weighed before and after each run to determine the mass loading on each filter. Concentration is then calculated if the air flow is known for each filter. Two rotometers are installed on the sampler to measure the flow during the run.

This type of instrument is divided into two sections: the sampling module and the control module. The sampling module contains the sampling head separation device, and the two filters. The control module contains the air pump, flow controller, rotameters, and the clock mechanism. The two units are connected by polypropylene tubing.

The sampling module is the portion where the actual separation and collection of each particle size is accommplished. The particles larger than 15 microns are eliminated at the round sampling head. A bug screen is placed in the sampling head to keep out insects and to collect particles larger than 15 microns. The particles less than 15 microns proceed down the sampling tube to the nozzle. The nozzle accelerates the particles and forces the majority of air (approximately 90%) to make a sharp 90° turn in a very short distance. This 90° turn is the principle on which the separation is based. Any heavy particle (i.e. any particle greater than 2.5 microns) will not be able to make this sudden turn. These particles will be drawn down into the coarse particles tube which is located straight below the nozzle. The other particles (less than 2.5 microns) will make the 90° turn and will be drawn down the fine particle tube. At the bottom of both tubes are the appropriate filters. The air flow is drawn from the control module through the 3/8" and 1/4" lines.

Analyte: Lead

Procedure: Atomic Absorption Spectrophotometry

General Information

Lead is sampled in the field using a standard hi-volume air sampler. This sampler pulls a large volume of air through a glass fiber filter. The filter is then normally mailed from the field site to the Air Quality Bureau where the sample is logged in. The volume of the air sample is calculated and then it is transferred to the laboratory for analysis. The filter is equilabrated and weighed for total suspended particulate. Then the filter must be extracted using an acidic solution to solubilize the lead on the filter. The resulting solution is analyzed using atomic absorption spectrophotometry to determine the amount of lead present.

Analyte: Sulfur Dioxide

Procedures: Pulsed fluorescence

General Information

The sample airstream is exposed to a pulsating ultraviolet light, which electromagnetically excites sulfur dioxide in the air sample. The excited SO_2 quickly decays to its ground state emitting a photon of fluorescent light, whose intensity is measured by a photomultiplier tube. The wavelength of excitation light entering the detection chamber and the wavelength of fluorescent light entering the photomultiplier tube both are carefully controlled by narrow bandpass filters, which reduce interference from other fluorescent species in the sample gas. The light is pulsed for six reasons: long UV lamp life, high intensity UV without lamp heating, small lamp size for UV output, low lamp power requirements, long term UV stability, and chopped signal processing (alternatively measuring signal and photomultiplier dark current). After the photomultiplier dark current is subtracted from the fluorescent SO_2 signal, the signal output is directly proportional to the concentration of SO_2 in the sample gas.

Analyte: Hydrogen sulfide and sulfur dioxide

Procedures: Gas chromatography and flame photometric detection

General Information:

Ambient air entering the analyzer is separated into two fragments by a gas chromatographic column, one part containing any sulfur dioxide present in the sample and the second component consisting of any hydrogen sulfide. The amount of sulfur atoms in each fragment is detected by a flame photometer. This detection principle consists of burning the sample in a hydrogen rich flame, which produces the excited reduced species S_2. The S_2 decays to ground state emitting a photon near 390nm. This photon is sensed by a photomultiplier tube. Because the measured molecule is a sulfur dimer, the photomultiplier output (picoamps) is nonlinear with respect to ambient sulfur concentrations. The output is approximately to the 1.8 power of the ambient concentration. Deviation from the theoretical second power is due to quenching of the excited species. The photomultiplier output is linearized by a set of logarithmeic amplifiers. The rest of the analyzer consists of flow control devices and temperature controllers for the detector oven and column.

Analyte: Nitrogen Oxides

Procedures: Chemiluminescent reaction of NO and O_3

General Information:

The analyzer utilizes a chemiluminescent reaction between nitric oxide and ozone to quantitatively determine the concentration of nitrogen oxides in the sample air. Ozone, produced in excess by ultraviolet irradiation of dried air, is reacted with any nitric oxide in the sample air and the resultant chemiluminescent photons are measured with a photomultiplier proportional to the amount of nitric oxide in the sample. A second portion of sample air is routed through a converter which changes all the NO_2 in the sample air to nitric oxide. This gas is reacted in another reaction chamber with the ozone and gives a measurement proportional to the total amount of nitrogen oxides in the sample. Thus, there are two parallel reaction chambers determining the nitric oxide concentration and the total nitrogen oxides concentration. These signals are electronically subtracted to give a nitrogen dioxide concentration.

Analyte: Ozone

Procedures: Ultraviolet photometry

General Information:

This analyzer works on the principle of absorption of ultraviolet light in the 254nm band by ozone. The principle is similar to an ultraviolet spectrophotometer with a 71cm folded gas cell. A sample of ambient air, selectively scrubbed of ozone, is injected into the cell. The attenuation of ultraviolet light without ozone is determined by a light sensitive diode. The sample cell is flushed and a new sample of air containing ambient levels of ozone is measured for ultraviolet absorption. The sample air without ozone is a reference cell measurement. The difference between the reference measurement and the sample with ozone measurement determines the ultraviolet absorption attributable only to the ozone. This absorption is proportional to the ozone concentration by the Beer-Lambert law. Since only a single detection cell is used in the instrument, ambient air and ozone-scrubbed ambient air are sequentially cycled through the cell. This cycle time is between 20 and 30 seconds. This means that the analyzer will not give correct values in situations in which the ozone concentration changes significantly in 30 seconds. This usually does not present a problem in enforcement monitoring but may be significant in low level research near point sources.

Analyte: Carbon Monoxide

Procedures: Non-dispersive Infrared

General Information:

The (carbon monoxide) analyzer measures continuous amounts of carbon monoxide from 0-50 to 0-1000 ppm full scale deflection. The detector operates on an infrared absorption principle.

The analyzer detects carbon monoxide from the absorption of infrared radiation. Nondispersive infrared radiation is introduced to the detector with a double-beam arrangement. The infrared beams pass through two cells: (1) a sealed reference cell filled with a non-absorbing gas, and (2) a sample cell through which the sample air containing the carbon monoxide is continuously drawn.

The Infrared Gas Analyzer utilizes the measurement principle based on CO having a known characteristic absorption spectra in the infrared range. The analyzer contains an infrared detector that uses the nondispersive single beam technique with alternate modulation of the sample and reference cells. The reference cell is filled with a nonabsorbing gas and sealed, and the sample is routed through the sample cell. With no CO present in the sample, the amounts of radiation coupled into the detector from the sample and reference cells will be essentially equal, effectively canceling in the detector and producing no output. When CO is present in the sample, some radiation is absorbed by the CO, causing the detector inputs to be unequal, and producing a capacitance change in the detector. The detector is so designed that the amount of capacitance change in the detector is equivalent to a known amount of CO. The infrared radiation is chopped by an optical chopper to cause a periodic capacitance change, which modulates a radio frequency signal from an oscillator. This signal is subsequently demodulated, amplified, and the output is fed to the front panel meter as well as to a strip chart recorder.

Analyte: Fluoride

Procedures: Dual paper tape collection of HF and particulates

General Information:

Sample air is drawn through the inlet tube and down through two paper tapes. The first tape is treated with citric acid and functions as a collector for particulates. The citric acid prevents the first tape from reacting with and absorbing gaseous hydrogen fluoride. The second tape is treated with sodium hydroxide and recovers better than 95 percent of the hydrogen floride at sampling times of 15 to 120 minutes with fluoride loads up to 40 ug/m^3. The sample air is drawn through a soda lime scrubber which removes the fluorides. The scrubbed air is drawn through a soda lime scrubber which removes the fluorides. The scrubbed air is used to pressurize the cabinet containing the sample tape rolls, thus preventing unwanted fluoride contamination of the tape by the instrument's operating environment. At preprogrammed time intervals the sampler shuts off the sample pump, indexes the tape and then samples a new section of tape. Approximately 600 samples can be collected on each tape set. The sample spots are cut out of the tape and subjected to one of the standard acceptable methods of fluoride analysis.

Analyte: Gaseous and particulate fluorides

Procedure: Bicarbonate tube

General Information:

Sample air is drawn through a glass tube which has sodium bicarbonate coated on the inner wall of the tube. The bicarbonate removes gaseous fluorides from the sample stream. A filter at the end of the tube captures the particulates from the sample. After the normal sampling interval (usually 24 hours), the sample flow is stopped. The filter is retained for analysis of particulate fluorides. The bicarbonate is washed out of the tube and analyzed for fluoride content. Recovery of gaseous HF is about 95% up until saturation of the tube at 500 ug F. Sample air which is high in acids (SO_2, NO_2, O_3 and hydrocarbons, at 50% or greater relative humidity) will react with the bicarbonate in the tube and reduce collection efficiency and total fluoride holding capacity. The lower detectable limit of the method is a function of the quality of the bicarbonate used for coating the tubes. Bicarbonate containing significant fluoride contamination will not have the low level resolution of fluoride free bicarbonate. The minimum detectable limit is determined as two standard deviations of the mean of the blank values. The blanks come from sample tubes which have been prepared for sampling but are maintained unexposed.

Analyte: Foliar Fluorides

Procedure: Colorimetric Method

General Information:

Forage samples are collected from pre-selected areas twice per month. Such areas must be growing hay or silage or being grazed by livestock when the samples are collected. Each sample consists of a composite of at least 25 clippings collected in a predetermined geometric pattern over the area. The entire aerial portion of the plant over 3 cm above the ground is collected.

The samples are collected and stored in Kraft bags under carefully regulated temperatures awaiting laboratory analysis. In the laboratory the samples are air dried at 80° C for 24-48 hours. The samples are then milled to pass a 40 mesh sieve. The milled samples are dissolved in solution, distilled, buffered and analyzed with a colorimeter or by the specific ion electrode procedure.

Analyte: Visibility

Procedure: Integrating Nephelometer

General Information:

The visibility is determined by the measurement of the atmospheric extinction coefficient due to light scattering by both gases and aerosols in the air. The quantitative output can be displayed in units of scattering coefficient, meteorological range, or mass concentration of particulates. The air is drawn into a one-meter long tube where light is flashed across the air stream at right angles to the photodetector. Any light scattered due to particulates will be detected and recorded on a strip chart recorder.

Analyte: Metals

Procedure: ICP or ICAP

General Information:

Samples are nebulized and the aerosol that is produced is transported to the plasma torch where excitation occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency inductively coupled plasma (ICP). The spectra are dispersed by a grating spectrometer and the intensities of the lines are monitored by photomultiplier tubes. The photocurrents from the photomultiplier tubes are processed and controlled by a computer system. A background correction technique is required to compensate for variable background contribution to the determination of trace elements. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. The position used must be free of spectral interference and reflect the same change in background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result.

APPENDIX O

Air Quality Data Inputs

APPENDIX O

AIR QUALITY DATA INPUT

Agencies and companies often need to input their air monitoring data to the state's computer system (AQDHS). This appendix is a brief summary of the various data forms and magnetic tape requirements for inputting data.

Figures AP-1-O through AP-4-O show four input forms used for hourly, daily, and monthly data. Forms 2179 and BAC are used for daily (24-hour) data while form BAQ is generally used for monthly data. The SAROAD form is used only for hourly data. Brief instructions for forms 2179 and SAROAD follow the figures. Some parameter codes are listed.

Agencies and companies may input their data on magnetic tapes. The data must be of the same format as the beforementioned input forms. Tape requirements are as follows:

Standard IBM label (if labeled)

Prefer Non-labeled (NL)

9-track tape

800, 1600, 6250 BPI's (specified)

80 characters

Any blocking size (specified)

EBCDIC

SAROAD on one file only

BAC, BAQ, 2179 one file only

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

Date Received: _____

Analyst: _____

Date Completed: _____

	2	7
1	2	3

HV Mem. Dichot.

Parameter	Parameter	Parameter	Parameter
23 24 25 26 27	37 38 39 40 41	51 52 53 54 55	65 66 67 68 69

Method Units DP	Method Units DP	Method Units DP	Method Units DP
28 29 30 31 32	42 43 44 45 46	56 57 58 59 60	70 71 72 73 74

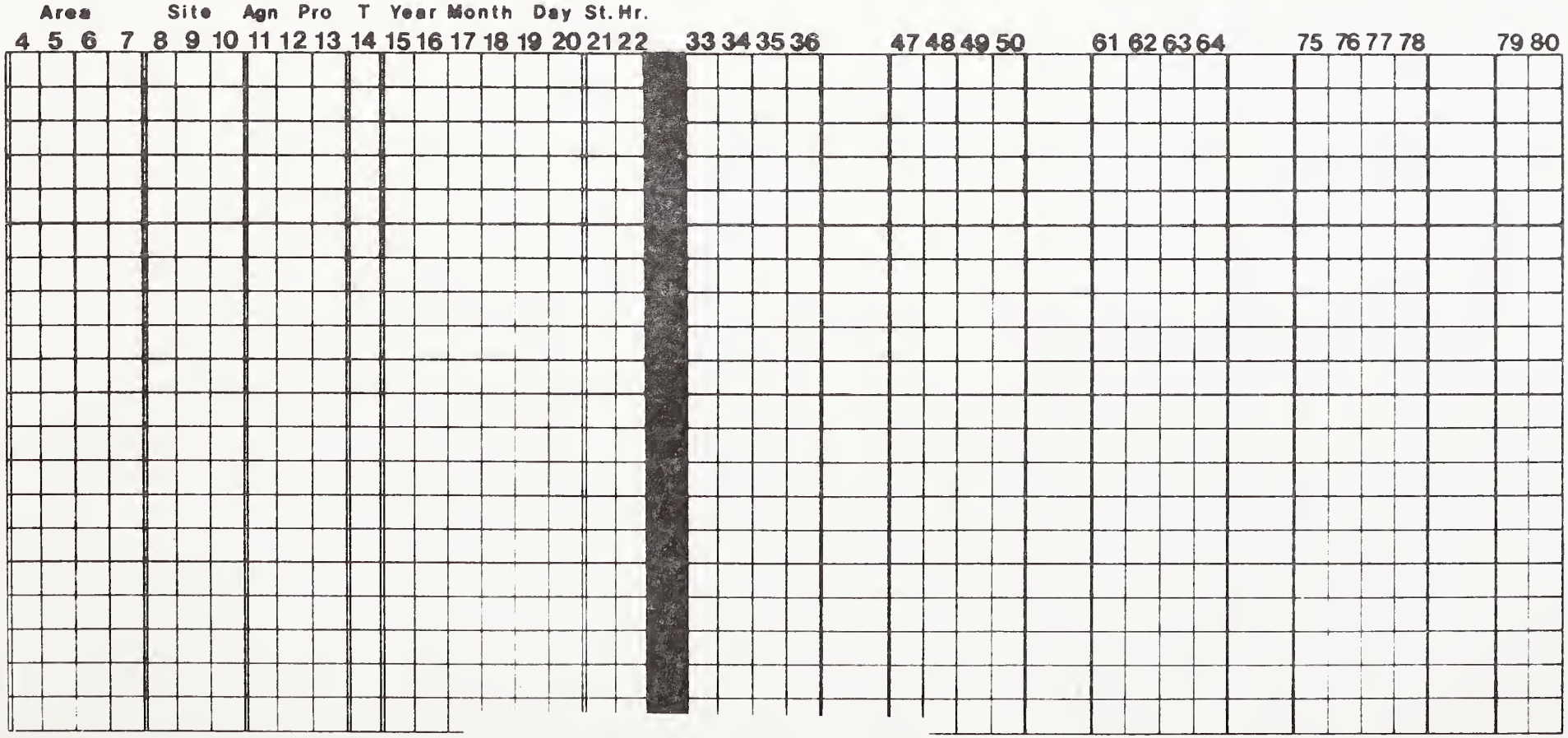


Figure AP-1-0

Form: 2179 Comments:

DATA INPUT FORM - 2179

MONTANA STATE DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
Helena, Montana

State	Agency	Project	Time	Year	Period (month)	Number of Spls.	Comp Spl. Type Time
2 3	11	12 13	14	15 16	17 18	19 20	21 22

2

Area Address

Collected By

Date Received Date Reported

Analyst

Comments or unusual activities:

Name PARAMETER Code	Name PARAMETER Code	Name PARAMETER Code	Name PARAMETER Code
23 24 25 26 27	37 38 39 40 41	51 52 53 54 55	65 66 67 68 69
Method Units DP	Method Units DP	Method Units DP	Method Units DP
28 29 30 31 32	42 43 44 45 46	56 57 58 59 60	70 71 72 73 74
33 34 35 36	47 48 49 50	61 62 63 64	75 76 77 78
4 3 2 1 0	4 3 2 1 0	4 3 2 1 0	4 3 2 1 0

Lab. No.	Sample No.	Location and Description	Date Out	Date In	Sampling Period	Area 4 5 6 7	Site 8 9 10

STATE DEPARTMENT OF HEALTH

AND ENVIRONMENTAL SCIENCES

HELENA, MONTANA

24-HOUR OR GREATER SAMPLING INTERVAL

2

1 Agency

City Name

Site Address

Project

Time Interval

State Area Site

2 3 4 5 6 7 8 9 10

Agency Pro. T. Year Month

11 12 13 14 15 16 17 18

Collection Day 19 20	Lab. No.	Filter No.	Date Sample Logged	Operator	Total Volume Air (M3)	Unusual Circumstance *	Day 19 20	21 22	TSP Name PARAMETER Code 23 24 25 26 27 Method Units DP 28 29 30 31 32	Org Name PARAMETER Code 37 38 39 40 41 Method Units DP 42 43 44 45 46	As Name PARAMETER Code 51 52 53 54 55 Method Units DP 56 57 58 59 60	Pb Name PARAMETER Code 65 66 67 68 69 Method Units DP 70 71 72 73 74	Day 19 20	Cd Name PARAMETER Code 23 24 25 26 27 Method Units DP 28 29 30 31 32	Zn Name PARAMETER Code 37 38 39 40 41 Method Units DP 42 43 44 45 46	$SO_4^=$ Name PARAMETER Code 51 52 53 54 55 Method Units DP 56 57 58 59 60	Name PARAMETER Code 65 66 67 68 69 Method Units DP 70 71 72 73 74
01							01						01				
02							02						02				
03							03						03				
04							04						04				
05							05						05				
06							06						06				
07							07						07				
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30							30						30				
31							31						31				

DP → 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0

158

Comments or unusual circumstances

* codes 0 = excess of 24 hr. 5 = dry
1 = approx. 72°F 6 = clear
2 = approx. 32°F 7 = hazy
3 = rain 8 = calm
4 = snow 9 = windy

BAQ
3/72

Figure AP-3-0

DATA INPUT FORM - BAQ

LESS THAN 24-HOUR SAMPLING INTERVAL

1 (1) Agency

AIR QUALITY BUREAU

State (2 3) Area (4 5 6 7) Site (8 9 10): 2 7

City Name

Parameter observed | Method

Agency (11) | Project (12 13) | Time (14) | Year (15 16) | Month (17 18)

Site Address

Time interval of obs. | Units of obs.

Parameter code (23 24 25 26 27) | Method (28 29) | Units (30 31) | DP (32)

Project

Day	St	Hr	Rdg 1	Rdg 2	Rdg 3	Rdg 4	Rdg 5	Rdg 6	Rdg 7	Rdg 8	Rdg 9	Rdg 10	Rdg 11	Rdg 12
19 20	21	22	33 34 35 36	37 38 39 40	41 42 43 44	45 46 47 48	49 50 51 52	53 54 55 56	57 58 59 60	61 62 63 64	65 66 67 68	69 70 71 72	73 74 75 76	77 78 79 80
01	00													
01	12													
02	00													
02	12													
03	00													
03	12													
04	00													
04	12													
05	00													
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08	00													
08	12													
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09	2													
10	00													
10	12													
11	00													
11	12													
12	00													
12	12													
13	00													
13	12													
14	00													
14	12													
15	00													
15	12													
16	00													

Figure AP-4-0

DATA INPUT FORM - SAROAD

FORM 2179

Col 1	Will always be coded 2, which indicates a 24-hour sample
Col 4-10	Area and site codes (different for each site, supplied by AQB)
Col 11	Agency code = J (indicates company, other letters indicates agencies)
Col 12,13	Project code = 02 (or 07 if sampler is colocated)
Col 14	Time code = 8
Col 15 - 20	Year, Month, Day the sample was run (YY,MM,DD)
Col 21, 22	Start hour = 00 (for all TSP readings)
Col 23 - 27	Parameter code = 11101 for TSP
Col 28,29	Method code = 91 for TSP
Col 30,31	Unit code = 01 for TSP
Col 32	Decimal code = 0 or 1 depending on analysis - but be consistent
Col 33-36	data
Col 37-46	Additional parameters
Col 47-50	space for data for parameter in Col 37-46, and so on
Col 80	always coded 2 to indicate new data

If a sample is void, write comments to the left of Col 4 - never write comments in the numered areas reserved for data.

SAROAD FORMS

These forms are numbered according to the days of the month. They are completed similarly to 2179 with these exceptions:

Col 14	Time code - 1 for hourly data
Col 23-32	Parameter, method, unit, decimal depending on monitoring equipment. See Parameter Code Description Table
Col 33-80	Data (for negative numbers contact AQB for correct procedure)

PARAMETER CODE DESCRIPTION TABLE

Parameter	Code	Method	Units	Decimal	Method Description
TSP	11101	91	01	0 or 1	Gravimetric
Wind Speed	61101	50	11	1	Electronic Avg-meters/second
	61101	40	12	1	Visual Avg-miles per hour
Wind Direction	61102	50	14	0	Electronic Avg-degrees
	61102	40	14	0	Visual avg-degrees
Wind Deviation	61106	50	14	0	Electronic Avg-degrees
Wind Peak	61110	50	11	0	Electronic-meters/second
	61110	40	12	1	Hourly peak-miles per hour
Temperature	62101	50	17	1	Electronic Avg-^{o}Centigrade
	62101	40	15	1	Machine Avg- ^{o}Farenheit
Dew Point	62103	50	17	1	Electronic Avg-^{o}C
	62103	40	15	1	Visual Ave-^{o}F
Barometric Pr	64101	11	16	1	Aneroid - millibars
	64101	11	22	1	Aneroid - inches mercury

APPENDIX P

Acronyms and Abbreviations

APPENDIX P

ACRONYMS AND ABBREVIATIONS

AA	Atomic absorption spectrophotometry
ACFM	Actual cubic feet per minute
ADP	Automatic data processing
AIRS	Aerometric Information Retrieval System
APCA	Air Pollution Control Association
APRAC	Urban diffusion model for CO
AQB	Air Quality Bureau
AQCR	Air quality control region
AQDHS	Air Quality Data Handling System
AQDM	Air Quality Display Model
AQMA	Air Quality Maintenance Area
ARM	Administrative Rules of Montana
As	Arsenic
ASTM	American Society for Testing Materials
BACT	Best Available Control Technology
B(a)P	Benzo-(a)-pyrene
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CALINE	California Line Model for CO
Cd	Cadmium
CDHS	Comprehensive Data Handling System
CDM	Climatological Dispersion Model
CEMS	Continuous Emission Monitoring System
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2	Carbon dioxide
CRM	Certified Reference Material
CRSTER	Single Source meteorological model
Cu	Copper
DAS	Data aquisition system
DHES	Department of Health & Environmental Sciences
DHS	Data Handling System
DNRC	Department of Natural Resources and Conservation
DSCF	Dry standard cubic feet
DSL	Department of State Lands
EA	Environmental Assessment
EIC	Environmental Information Center
EIS	Environmental Impact statement
EIS/P&R	Emission Inventory System/Permits and Registration
EPA	United States Environmental Protection Agency
EQC	Environmental Quality Council
ESD	Environmental Sciences Division
ESP	Electrostatic Precipitator
ES&T	Environmental Science and Technology

F	Fluorine (fluoride)
FAA	Federal Aviation Administration
FBC	Fluidized bed combustion
FGD	Flue gas desulfurization
FID	Flame Ionization detector
FPD	Flame photometric detector
G or (g)	Grams
GC	Gas chromatography
GR or (gr)	Grains
HC	Hydrocarbons
HF	Hydrofluoric acid
HIWAY	Meteorological model for CO
HPLC	High performance liquid chromatography
H_2O	Oxide of hydrogen
H_2S	Hydrogen sulfide
H_2SO_4	Sulfuric Acid
ICP/ICAP	Inductively Coupled Plasma; Inductive Coupled Argon Plasma
I/M	Inspection and maintenance
IP	Inhalable particulates
ISC	Industrial Source Complex model
JAPCA	Journal of Air Pollution Control Association
LAER	Lowest achieveable emission rate
M	Meter
M^3	Cubic meters
MAAQS	Montana Ambient Air Quality Standards Study
MAPS	Montana Air Pollution Study
MCA	Montana Codes Annotated
MCAA	Montana Clean Air Act
MEPA	Montana Environmental Policy Act
MHD	Magnetohydrodynamics
MS	Mass Spectrometry
MCCHD	Missoula City-County Health Department
MO	Montana Office (EPA)
Mu	Micron
NA	Neutron Activation or Nonattainment
NAAQS	National Ambient Air quality Standards
NADB	National Aerometric data Bank
NADP	National Atmospheric Deposition Program
NAMS	National Air Monitoring Station
NBS	National Bureau of Standards

NDIR	Nondispersive Infrared Analysis
NEDS	National Emission Data System
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for hazardous air pollutants
Ni	Nickel
NMHC	Non methane hydrocarbons
NMR	Nuclear magnetic resonance
NOAA	National Oceanic and Atmospheric Administration
NOx	Oxides of Nitrogens
NO_2	Nitrogen dioxide
NO_3	Nitrate
NPRC	Northern Plains Resource Council
NSPS	New source performance standards
NTIS	National Technical Information Service
NWS	National Weather Sevice
O	Oxygen atom
O_2	Oxygen molecule
O_3	Ozone
PAL	Point, area and line source air quality model
Pb	Lead
PBL	Planetary boundary layer
PER	Preliminary Environmental Review
PM	Preventive Maintenance
PNA	Polynuclear aromatic hydrocarbon
POM	Polycyclic organic matter
PPM	Parts per million
PSD	Prevention of Significant Deterioration
PSI	Pollutant standards index or pounds per square inch
PTDIS	Single stack meteorological model
PTMAX	Single stack meteorological model
PTMTP	Multistack meteorological model
P&A	Precision and accuracy
QA	Quality Assurance
RACT	Reasonably available control technology
RAM	urban air model for point and area sources
RP	Respirable particulates
S	Sulfur
SAMWG	Standing Air Monitoring Work Group
SAROAD	Storage and retrieval of aerometric data
SI	International system of units
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur Dioxide
SO_4	Sulfate
SPM	Special purpose monitoring station
SPSS	Statistical Package for the Social Sciences
SRM	Standard reference materials
SWMB	Solid Waste Management Bureau

APPENDIX Q

AQCR's and Area Codes

APPENDIX Q

AQCR'S AND AREA CODES

As per the Clean Air Act, the Administrator for the EPA divided the State into geographic areas or air quality control regions (AQCR). These are as follows:

AQCR	Name
140	Billings
141	Great Falls
142	Helena
143	Miles City
144	Missoula

Figure AP-1-S shows the boundaries of Montana's five AQCR's on a map of the state.

Area codes for Montana are listed on Table AP-S-I.

AQCR's and area codes are used by data users for requesting or processing data.

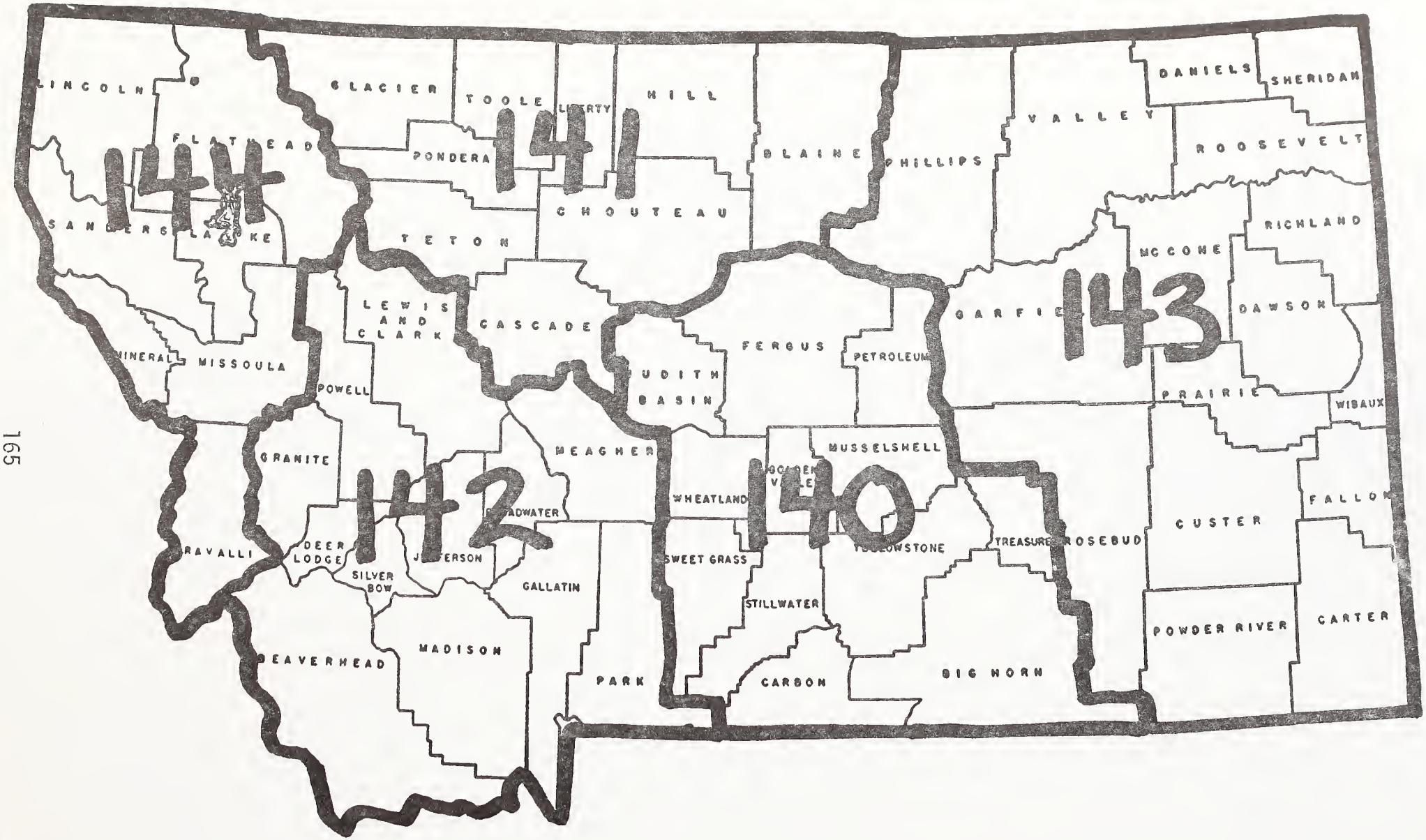

Figure AP-1-Q

MONTANA AIR QUALITY CONTROL REGIONS

Table AP-Q-I

MONTANA AREA CODES

0020 ANACONDA
0030 BAKER
0040 *BEAVERHEAD
0060 *BIG HORN
0090 BILLINGS

0100 *BLAINE
0120 BOZEMAN
0140 *BROADWATER
0160 BUTTE
0180 *CARBON

0200 *CARTER
0220 *CASCADE
0240 CENTERVILLE DUBLIN GULCH
0260 *CHOUTEAU
0270 COLUMBIA FALLS

0280 CONRAD
0300 *CUSTER
0320 CUT BANK
0340 *DANIELS
0360 *DAWSON

0380 DEER LODGE
0400 *DEER LODGE
0420 DILLON
0440 *FALLON
0460 *FERGUS

0480 *FLAT HEAD
0500 FLORAL PARK
0520 *GALLATIN
0540 *GARFIELD
0560 *GLACIER

0570 GLACIER NAT PARK
0580 GLASGOW
0600 GLENDIVE
0620 *GOLDEN VALLEY
0640 *GRANITE

0660 GREAT FALLS
0670 HAMILTON
0680 HARDIN
0700 HAVRE
0720 HELENA

0740 *HILL
0760 *JEFFERSON
0780 *JUDITH BASIN
0800 KALISPELL
0920 *LAKE

0840 LAUREL
0860 *LEWIS AND CLARK
0880 LEWISTOWN
0900 LIBBY
0920 *LIBERTY

0940 *LINCOLN
0960 LIVINGSTON
0980 *MC CONE
1000 *MADISON
1010 MALMSTROM

1020 *MEAGHER
1040 MILES CITY
1060 *MINERAL
1080 MISSOULA
1085 MISSOULA SOUTH

1090 MISSOULA WEST
1100 *MISSOULA
1140 *MUSSELSHELL
1160 *PARK
1180 *PETROLEUM

1200 *PHILLIPS
1220 *PONDERA
1240 *POWDER RIVER
1260 *POWELL
1280 *PRAIRIE

1300 *RAVALLI
1320 *RICHLAND
1340 *ROOSEVELT
1360 *ROSEBUD
1380 ROUNDUP

1400 *SANDERS
1420 SHELBY
1440 *SHERIDAN
1460 SIDNEY
1480 *SILVER BOW

1500 SILVER BOW PARK
1520 *STILLWATER
1540 *SWEET GRASS
1560 *TETON
1580 *TOOLE

1600 *TREASURE
1620 *VALLEY
1640 *WHEATLAND
1660 WHITEFISH
1680 *WIBAUX

1700 WOLF POINT
1720 *YELLOWSTONE
1740 YELLOWSTONE NAT PARK

250 copies of this public document were published at an estimated cost of $6.80 per copy, for a total cost of $1,700.87, which includes $1,415.87 for printing and $285.00 for distribution.